

Assessing the effect of imports on refractory brick manufacturers in South Africa

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ABSTRACT

The immense competition due to international trade is bedevilling various industrial sectors in South Africa. Numerous South African manufacturing industries are bearing the brunt of this inapt predicament. While the local consumers are privileged with significant benefits due to the increased options, the plight of many local industries such as refractory producers might not be fully understood. Therefore, it was imperative for this research study to interrogate the effects of imported refractory bricks on the operations of the local refractory brick manufacturing companies in South Africa.

A detailed review of the literature established the challenges faced by refractory brick producers in South Africa due to trade, and identified the gaps in the existing body of knowledge. A critical analysis of global refractory brick trade, refractory global supply chains and competitors brought the challenges faced by local producers to the fore. The literature uncovered numerous quandaries and hurdles such as shrinking local market, reduced turnover, reduction in production throughput, closure of some refractory producers, lower employment levels and capacity utilisation.

The quantitative research design approach was utilised to address the research questions and meet the objectives. A questionnaire that sought to establish the effects on the various organisational value chains was issued to a sample of 50 respondents who provided an excellent response rate of 74%. The obtained data was statistically analysed to identify the correlations imports to the various organisational value chains such as sales, market share, production output, capacity utilisation and unemployment.

Negative correlations were identified between the quantity of refractory brick imports in South Africa and the operational functions of the local refractory producers such as sales, market share, production throughput, refractory job market and capacity utilisation. The findings proved that an average perceived negative effect of refractory brick imports on the operations of the local producers in South Africa was a negative 76.92 percent correlation. This negative correlation is very high and ultimately unsustainable for the local refractory brick producers.

The study provided recommendations for the refractory industry, government, and the private sector, and also included recommendations for future research. Recommendations for government are anchored on the need to impose protectionist policies such as harsher import tariffs on refractory bricks in order to safeguard the industry from an impending failure

and total collapse due to international trade effects. Critical recommendations for the refractory industry entailed the adoption and crafting of strategies to curb the effects of imports such as expanding into regional geographical markets in sub-Saharan Africa and the adoption of lean manufacturing principles.

KEYWORDS

Refractory materials, refractory bricks, sales, market share, capacity utilisation, unemployment, globalisation and trade, operations

DECLARATION

I, **Brighton Mapiku**, solemnly declare that this dissertation work, **Assessing the effect of imports on refractory brick manufacturers in South Africa** is submitted in partial fulfilment of the requirements for the degree Master in Business Administration (MBA) at the North-West University, Business School. This submission is my work and has never on any previous occasion been presented in part or whole to any institution or board for the awarding of any degree. I declare that all the sources used or quoted have been indicated, highlighted and acknowledged by proper referencing.

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ABBREVIATIONS

CPI	Consumer Price Index
EMS-REC	Economic and Management Sciences Research Ethics Committee
DTIC	Department of Trade Industry and Competition
GDP	Gross Domestic Product
HS Code	Harmonized Commodity Description and Coding System
IMF	International Monetary Fund
NWU	North-West University
OEC	The Observatory of Economic Complexity
SCERF	Scientific Committee Recommendation Form
SPSS	Statistical Package for the Social Sciences
Real GDP	Real Gross Domestic Product
RMS	Refractory and Metallurgical Solution
WTO	World Trade Organization

DEFINITION OF KEY TERMS

Refractory materials are a group of technical ceramics, which can withstand heat, chemical attack, abrasion, thermal shock, rough handling and are commonly utilised in the containment of hot or molten material during processing and transportation (Hloben, 2000:10). Refractories may be categorised based on form or configuration or visible shape, as monolithics (unshaped) and shaped refractories. The range of shaped refractories comprise dense bricks, fusion cast, ceramic fibre products, insulation firebricks and speciality shapes. Monolithics or unshaped refractories mainly comprise castables, gunnables, rammables, fettling materials, plastics, mouldables, mortars and pumpables (Holben, 2000:12).

Effect is defined as the result of a particular influence or something that happens because of something else (Cambridge Dictionary, 2021).

Market share is defined as the percentage or fraction of the total sales revenue in an industry that is generated by a specific company or organisation. Market share may be calculated by the company's sales over the particular period and dividing it by the total sales of the industry over the same period (Hayes, 2020).

Globalisation and trade

"Globalisation is defined as the spread of products, technology, information, and jobs across national borders and cultures" (Investopedia, 2020). In economic terms, it describes an interdependence of nations around the globe fostered through free trade (Kopp, 2019). International trade hinges differing distribution of resources among countries, technologies and customer preference of imported goods (Van Rensburg *et al.*, 2015:470).

Operations

Operations management creates value in the form of goods and services by transforming inputs into outputs. In manufacturing firms, the production activities result in the creation of tangible products (Hezer *et al.*, 2017:42).

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1 CHAPTER 1: NATURE AND SCOPE OF THE STUDY

1.1 INTRODUCTION

This research study focuses on assessing the effects of imports on refractory brick manufacturers in South Africa. It is a quantitative study that aims to clarify the notion of influence and effects, exhibited by imported products on the local manufacturing industry.

This chapter introduces the sections of the research, including the research topic, underpinning background, problem statement and core research question, the research objectives, the importance as well as benefits of the proposed study. The introductory chapter also focuses on the key terms and provides an overview of the structure for the rest of the research. The research investigates the effects of imports of refractory bricks on local refractory brick manufacturers in South Africa.

1.2 BACKGROUND

Since the dawn of the Bronze and Iron ages, man has learnt to harness the value of mineral rich materials through the art of metal smelting (History Channel, 2020). According to the Cambridge Dictionary (2020), smelting refers to the art of obtaining a metal from mineral rock by heating it to a very high temperature, or of melting objects made from metal in order to use the metal to make something new.

Over the course of various paradigms and industrial revolutions, metal smelting formed the foundation of man's daily life needs from household utensils to general tooling, weaponry and widespread construction elements (History Channel, 2020). The smelting process is critical for numerous industrial applications in mining, as well as mineral and chemical processing, including but not limited to glass manufacturing, iron and steel making, platinum processing, cement manufacturing, ferroalloys processing and foundries (Dickinson, 2020). Without the smelting process, the present-day world would be totally different and devoid of any steel, glass, cement and various other smelted products that shape our world.

Underpinning the smelting process is one critical component, i.e., the refractory materials that contain the molten material insulate the process from the environment and enable process transportation (Hloben, 2000:12). It is worth noting that refractory production complements and buttresses the smelting process as an input to the processing units such as furnaces. According to Hloben (2000:10), refractory materials are a group of technical

ceramics, which can withstand heat, chemical attack, abrasion, thermal shock, and rough handling, and are commonly utilised in the containment of hot or molten material during processing and transportation. Refractory materials have been used since the bronze and iron age during metal smelting; early man predominantly used clay as the primary source for construction of the furnaces (Friede, 1979). Refractories may be categorised based on form or configuration or visible shape, as monolithics (unshaped) and shaped refractories. Bricks are classified among the shaped refractories; they are usually dense, self-supporting and more resistant to corrosion (Hloben, 2000:12).

The advent of mass production and increased steel demand due to wartime needs resulted in the establishment of steel companies in South Africa in the 19th century (ArcelorMittal SA, 2020). Subsequently refractory requirements for the steel plants and other newly constructed smelting companies skyrocketed resulting in the founding of local refractory manufacturing companies. The renowned relationship among the major smelting companies, refractory producers and refractory service providers in South Africa, has been in existence for over 100 years (Dickinson, 2020). The refractory industry is well established with an excess of 12 firms manufacturing refractory materials in South Africa presently; the majority specialising in refractory bricks, monolithic refractories, provision of niche installations services and technical support (Gauteng Region, 2021).

Since the dawn of the 21st century, increased competition through the influx of imports, reduced market volumes due to economic distress, and subsequent closure of certain steel plants, foundries and other smelting companies, significantly contributed to adverse operational challenges and the subsequent closure of some refractory manufacturing companies (du Plessis, 2015).

1.3 PROBLEM STATEMENT AND CORE RESEARCH QUESTION

Increased global competition has forced many organisations to stringently monitor importations of competing products in home markets. The impetus of the World Trade Organisation has witnessed increased globalisation of services and merchandise (WTO, 2019). It is more important than ever, for any business, academic, management, public and private organisational institution to note the paradigm shift and dynamic changes in particular industries due to the effects of increased merchandise importation. According to a study by Mogoe (2014:7) on the impact of foreign trade on economic growth in South

Africa, inflation rate, exports and exchange rate are positively related to GDP, while imports have a negative influence on GDP. (Mogoe, 2014).

There exists a school of thought that cheap imported products contribute to the undermining of development in Africa by prohibiting and thwarting growth of the manufacturing sector, which would have created jobs and wealth under normal circumstances (Mazo & Munapo, 2017). The perceived notion within the refractory industry is that imports of refractory bricks have an adverse and unpropitious impact on the local manufacturer's competitiveness.

The South African refractory industry has two major challenges in the local market, namely increased foreign competition through imports, and a shrinking local market. Both challenges may be directly or indirectly linked to importation of merchandise into the country, which subsequently increases direct competition, pushing some local manufactures out of business thereby shrinking the local industry.

In accordance with the stated problem, the framework of the research study is aimed at investigating the following core research question:

- How do imports of refractory bricks into South Africa affect the operations of the local brick manufacturers?

The results of this study will assist the refractory manufacturing industry to encapsulate the current situation holistically based on the applied structured approach with detailed findings. The results and recommendations will stimulate effective, strategic, sound and tactical decision-making responses to the imports within the refractory manufacturing sector. The research will add to the existing body of knowledge by providing valuable insight into the relationship between imported goods and their effect on local operations of the refractory manufacturing industry.

1.4 RESEARCH OBJECTIVES AND SPECIFIC RESEARCH QUESTIONS

The objectives were categorised as primary and secondary or specific.

1.4.1 Primary objective

The primary objective of the study is to investigate, determine and assess the effects of refractory brick imports on the operations of local brick manufacturers in South Africa. The

researcher sets out to investigate any link between the importation of refractory brick and the state of operations of the local producers of refractory bricks.

1.4.2 Secondary objectives

In order to achieve the primary objective, the following specific objectives were formulated:

- To assess the challenges faced by refractory producers in South Africa due to trade.
- To empirically assess and establish the extent to which operational value chains of local refractory brick producers are influenced by the quantity of imports of refractory bricks in the market.
- To draw conclusions and recommendations on what strategies the industry may employ to remain competitive, sustainable, retain existing market share and foster growth.

1.4.3 Specific research questions

The specific research questions are as follows:

- How do imports affect the sales growth and market share of local players?
- How do imports influence the local production output, capacity utilisation and plant loading?
- How do imports influence local industry employment levels?

1.5 IMPORTANCE AND BENEFITS OF THE PROPOSED STUDY

Industry and consumers have been ambivalent and equivocal on the pros and cons of globalisation and its adverse effects on the local industry and micro-economy. Numerous refractory manufacturing companies blame the decline in refractory sales, pressure on pricing, reduced margins, subsequent closure of some companies, deindustrialisation and increased unemployment in the sector on direct import competition (du Plessis, 2015). It is imperative to perform an investigation to substantiate, validate or dismiss the claims based on the actual impact on the local refractory manufacturing industry. The validation of adverse and unpropitious impacts would provide a comprehensive viewpoint and guide to the diverse practitioners and stakeholders such as management, refractory industry, private sectors, government entities and policy-makers at large. Importance and benefits of the research may be summed up as follows:

1.5.1 Refractory industry in South Africa

The research shall provide invaluable insights with respect to the refractory industry players in South Africa, management and employees. According to Seal *et al.* (2019:4), managers are chiefly responsible for planning, directing, motivating, controlling and decision-making within an organisation. The findings of the research will enable refractory industry management to strategise and make informed decision pertaining to the following:

- **Sales**

Management will be able to clearly identify industry trends with respect to sales and sale growth initiatives. The clear implication would be an immediate need for planning and decision-making in order to address the market concerns and foster growth. The implications might involve overall re-evaluation of the core product offerings in order to address the downward trend of sales. Furthermore, implications will require crafting of strategic marketing plans that ward off the foreign competition and strengthen the market position of local players.

- **Market share**

Management will clearly pinpoint and recognise the prevailing industry market structure and market share dynamics. This will enable management to initiate action plans to foster market share growth or maintain market share depending on the findings.

- **Production operations**

The research findings will lay out the implications of the imports on the operations of the brick plant. The implications might encompass changes in plant utilisation, plant loading, production throughput, plant equipment, investment in new equipment, and manufacturing philosophy to address impact of foreign competition on the local market.

- **Human resources**

The investigation will offer invaluable managerial insights regarding the impact of the market dynamics on human resource utilisation, occupations, skills development, manpower attrition and unemployment.

1.5.2 Private sector and public enterprises

The refractory brick manufacturing industry is based on an oligopoly market structure within South Africa, and has been for many years, with fewer than five local manufacturers.

According to Van Rensburg *et al.* (2015:144), an oligopoly is a market structure that comprises few sellers, with standard or differentiated products, comprising significant barriers of entry and typically each firm is affected by the decisions of its rivals, and therefore must take their competition's decisions into account to determine its own output and pricing.

The introduction of additional competitors on the local markets through direct imports and foreign competitors eliminates the significant barriers of entry resulting in a market structure shift to a monopolistic competition or pure competition on product variants. It is imperative for the private and public sector organisations to take note of such case studies in order to identify the early warning signs, learn from the different industrial sectors and employ strategies to respond swiftly to market shifts or anticipated market shifts.

1.5.3 Government and policy-makers

The investigation will offer invaluable insights regarding the effects of the imports on the concept of deindustrialisation and unemployment in South Africa. According to Imbs (2013), there is evident deindustrialisation of the South African economy, suggesting that trade, both local and global, contributes to the structural change from manufacturing to services, which leads to higher unemployment rates. The structural shift to services does not support more employment, but rather tends to have a lean structure. It is critical for government and policy-makers to note the detrimental effects of free trade on the local manufacturing industry, employment rates and society at large. It is the author's hope that this addition and contribution to literature on the effects of trade will foster changes, restrictions and protectionist policies on the import of certain locally manufactured products.

1.5.4 Economists, sales practitioners and research scholars

The research will add to the existing body of knowledge for scholars, economists and sales practitioners. The investigation will aid as a case study of the refractory industry, an oligopoly market under strain and microeconomic analysis of the effects of imports.

1.6 RESEARCH METHODOLOGY

1.6.1 Literature study

The essence of a literature study is to generate and refine research ideas and also critically review the literature. Reviewing literature is an essential part of research required to

demonstrate awareness of the current state of knowledge in the field of study, enhance subject knowledge and assist in clarifying the research questions (Saunders *et al.*, 2007:54).

To establish a holistic view of the background, challenges and situation under review, the author reviewed numerous relevant journal, articles, books and dissertations. The following listed sources of literature were considered:

- North-West University Library: Boloka Institutional Repository (NWU-IR)
- Google Scholar
- EBSCO Discovery Service (EDS): International journals, books and online resources
- Academic Business Textbooks
- World Trade Organization
- International Monetary Fund Publications
- Statistics South Africa Publications
- World Bank Publications

Chapter 2 provides research study justification through an extensive literature review to identify the gaps in the existing body of knowledge. The literature was reviewed regarding globalisation, international trade, developing economies, South Africa's trade balance, refractory materials, the global refractory industry, the refractory industry in South Africa, and the value chains of refractory brick producers.

1.6.2 Description of the overall research design

The overall design was based on the quantitative research approach, deductive perspective and longitudinal design with a post-positivist epistemology. The quantitative research approach enabled convenient gathering of a vast amount of data within the limited timeframe while enabling the researcher to obtain a sample and generalise the findings of the population (Bryman *et al.*, 2014:31). The study involved simultaneous collection of data through surveys and secondary data in order to infer theoretical ideas on the causality of variables (Bryman *et al.*, 2014:34).

The study undertook a longitudinal design that is primarily associated with mapping changes over a specific period and contextualising the processes influencing change. According to Bryman *et al.* (2014:109), longitudinal research provides a platform for analysing occurrences vertically and horizontally in order to detect the correlations of the variables. The investigator obtained high quality data as historical records on refractory imports from

credible official statistics, public platforms and databases. The historical operation records were obtained from refractory manufacturers directly. Furthermore, a social survey was conducted through self-completion questionnaires. The ease of access and convenience of secondary data reduced the time and cost constraints of the longitudinal design approach.

1.6.3 Target population and sampling

According to Bryman *et al.* (2014:170), the study population refers to the universe of all units from which a sample is chosen or selected. The total study population for this research study comprised all employees in the two prominent refractory brick manufacturing companies in South Africa. The unit of analysis for the research study was the two major refractory brick manufacturing companies in South Africa.

A sample is defined as a portion of the population that is selected for investigation (Bryman, *et al.*, 2014:170). According to Bryman *et al.* (2014:186), purposive sampling implies non-probability and strategic sampling that is executed to ensure that sample cases are practically applicable and relevant to the research questions. The sample for the research study was defined as decision-makers and managers working for the refractory brick manufacturers in South Africa, at the time of the investigation. The selected sample comprised 50 managers and decision-makers.

1.6.4 Data collection

To achieve the objectives of the research study, empirical research was conducted within the refractory brick manufacturing companies in South Africa. The questionnaire was utilised as the effective data collection instrument for primary data with respect to the target group. Secondary data was sourced from credible official statistics, public platforms and databases regarding the importation of refractory bricks.

The questionnaire consisted of five demographic questions and 24 content-related questions. The demographic section aimed to collect the biological and demographic data regarding gender, experience, level of education, duration in current occupation and functional department. The adapted questionnaire consisted of three sections that were measured using a seven point Likert scale with the following scores:

Table 1: Likert scale

1	2	3	4	5	6	7
Strongly disagree	Moderately disagree	Slightly disagree	Neither agree nor disagree	Slightly agree	Moderately agree	Strongly agree

1.6.5 Data analysis

To accomplish the purpose of the research study, statistical analysis methods and approaches were utilised using the Statistical Package for Social Sciences (SPSS) software. The Statistical Consulting Services at the North-West University extensively assisted with the statistical analysis and adopted questionnaire structuring.

Descriptive analysis was used for ascertaining the distribution of variables such as measures of central tendency (mode, mean, mode) and measures of dispersion, such as the range, variance and standard deviation (Bryman *et al.*, 2014:319). Bivariate analysis was utilised for analysing the relationship and correlation between the variables. The researcher employed bivariate analysis for analysing the correlation in order to ascertain the relationship between the import quantities and performance indicators. The data analysis process included correlation analysis in order to determine the strength and direction of the relationship between two variables.

In conclusion, data was analysed to investigate the relationship between import quantities of refractory bricks and performance indicators of the local refractory brick manufacturers. Chapter 3 provides the extensive empirical study including the data analysis approach.

1.7 RIGOUR, VALIDITY AND RELIABILITY

The study employed thorough research fundamentals and strategies to ensure the quality and rigour of the proposed research design. The three most important and critical criteria of reliability, replication and validity were implemented during the research study. In addition, the study bears the three primary considerations of measurement, causality and generalisation (Bryman *et al.*, 2014:39).

1.7.1 Reliability

Reliability refers to the extent to which measures are accurate and produce consistent results (Thanasegaran, 2009). In quantitative research, reliability anchors or determines whether a particular measure is stable or not. For example, if a particular measure fluctuates wildly when administered on different occasion, it is deemed unstable and therefore unreliable (Bryman *et al.*, 2014:24). The research study ensured reliability by using the Cronbach's alpha test.

1.7.2 Replication

Replication implies the ability to replicate and reproduce the findings of other researchers by establishing whether the original results are applicable and valid within a different context. Replicability is highly valued in quantitative research, and henceforth the author will expound on the procedures that constitute the measure in great detail for ease of replication (Bryman, *et al.*, 2014:24).

1.7.3 Validity

Validity aims to establish the integrity of results generated from the research and may be classified to include measurement validity, internal validity, external validity and ecological validity. The measurement validity is strongly aligned to reliability of the measurement instrument and its stability. Internal validity questions whether the conclusion of a causal relationship between two or more variables holds water. The triangulation of multiple sources of data will be used to corroborate the research question. The quantitative research approach presents the investigator with an opportunity to generalise the findings and ensure external validity. The author provided representative samples in order to ensure external validity of the results. The research topic dealt with the importation of cheap goods into the local market, which is a common phenomenon in the modern-day 21st century era, and therefore concludes the ecological validity of the investigation (Bryman *et al.*, 2014:24).

1.8 ETHICAL CONSIDERATION

The research project upheld ethical principles and practices as approved by the Economic and Management Sciences Research Ethics Committee (EMS-REC). The upheld principles and matters include the following:

- Confidentiality, respect and protection of the identities of the respondents and institutions.

- Transparency through clear description of the research and its objectives to the respondents.
- The signed informed consent forms as endorsements of voluntary participation.
- Clear description of the relationship between the researcher and the participants and the expected benefits of the study.

The respondents were all briefed on the intention of the academic study beforehand. In addition, the issued questionnaire included the informed consent form that clearly stipulated anonymity of their identities, voluntary participation, as well as the purpose and intent of the academic research.

1.9 SCOPE OF THE STUDY

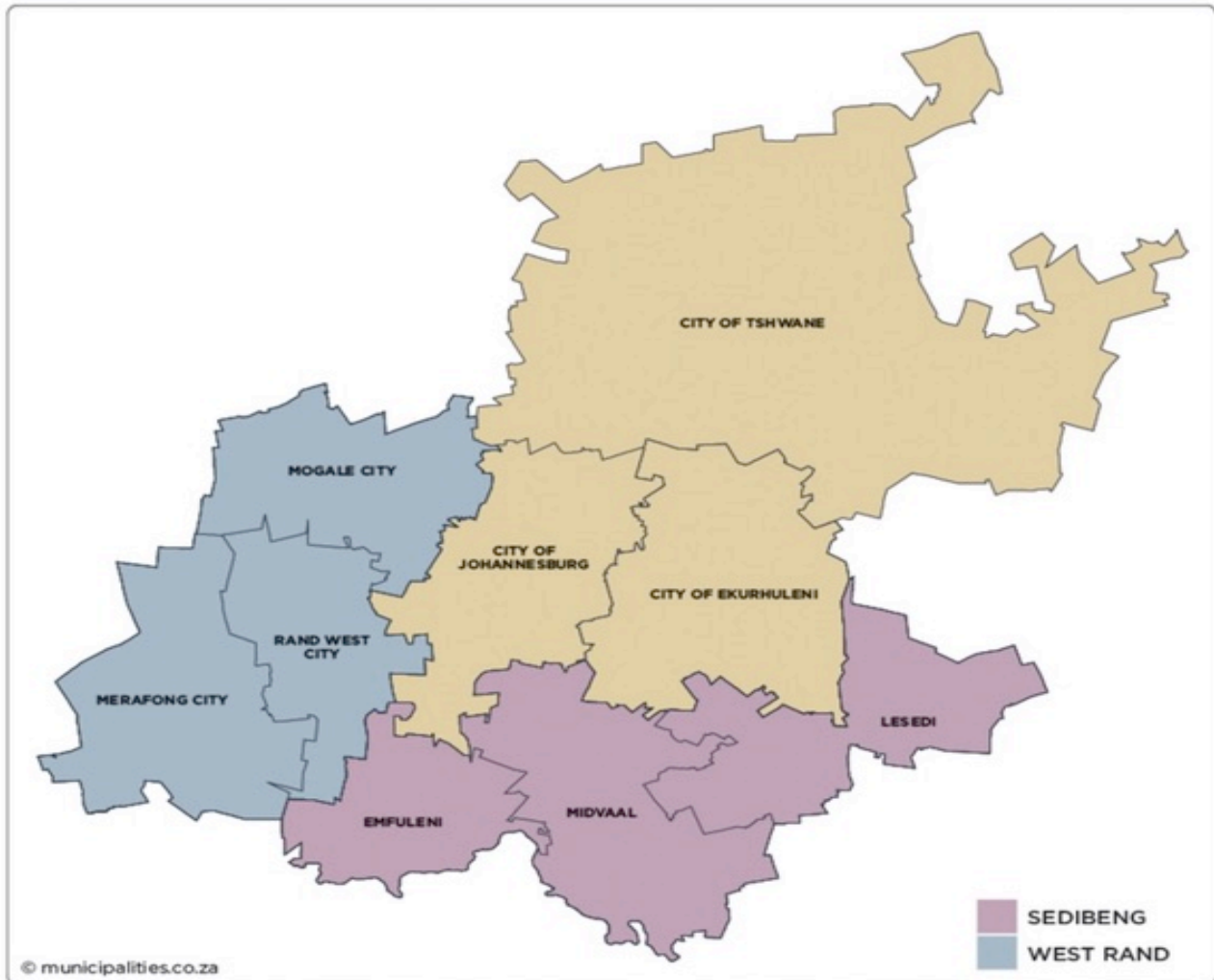
The focus of the study was to assess the effects of refractory merchandise imports on the operations of local producers. The study encompassed the fields of economics, marketing, sales and operations management. The specific industry of focus was the refractory industry.

The scope of research project included the following:

- Investigation and quantification of the refractory brick imports into South Africa.
- Establish the number of refractory bricks that local role players manufacture. The influence of refractory bricks that the local industry is incapable of producing was excluded from the scope.
- Identification of the comprehensive set of operations performance factors and value chains within the refractory industry that are affected by importation of refractory bricks.
- Primary data collection through self-administered questionnaires
- Secondary data collection and trend analysis
- Data analysis in the form of descriptive, bivariate and correlation through SPSS – Statistical Package for the Social Sciences.
- Conclusion and results publication on the impact assessment based on the primary and secondary data collected and analysed.

The research study population was based in the Gauteng Province and the two refractory brick manufacturing companies are located in Sedibeng and the City of Ekurhuleni.

Figure 1:Gauteng Province map



Source: Municipalities (2021)

1.10 ASSUMPTIONS

The underlying assumptions of the study were as follows:

1.10.1 Market

The market share or market structural changes were majorly attributed to the introduction of new products from foreign markets. Market changes are influenced by internal operating conditions and the introduction of new producers locally. For example, lowered production throughput results in insufficient quantities to cater for the market demands and needs.

Additionally, the introduction of a new producer impacts on the market share of competitors. Therefore, for purposes of this investigation and research project, there were no potential new producers that were identified and if present, their influence was treated as insignificant to the research study results. Any local traders of refractory bricks within South Africa were treated as importers.

1.10.2 Operations

The research assumed that the manufacturing operations of refractory brick producers were in good operating condition with ample capacity to meet the local market demand. The assumption was valid based on the specific range of refractory bricks that local producers are capable of manufacturing.

1.10.3 Manpower

The employment or manning levels of the brick plants were influenced by the plant loading and base capacity of the production facility. The labour planning and stability policy was assumed to hold employment constant at demand (Hezer, *et al.*, 2017:448). Any changes in labour planning and stability policy were attributable to market and demand changes.

1.11 OVERVIEW

The layout of this mini-dissertation report is as follows:

Chapter 1: Introduction

The introductory chapter describes the research title, background, the research problem, the primary question, research objectives, the importance of the proposed study and the research layout and dissertation structure.

Chapter 2: Literature review

Detailed theory on importation, globalisation and the status of refractory industry in South Africa was reviewed. The literature review furnished and identified the gaps in research and unanswered questions regarding the effects of imports on the operations of the refractory industry.

Chapter 3: Empirical study

Chapter 3 provides the research design, sampling design, unit of analysis, data collection and data analysis procedures. The data collection for secondary and primary data was discussed and implemented. The chapter details the results and comprehensive discussion in relation to fulfilment of the research objectives.

Chapter 4: Results, discussions and interpretation of findings

The chapter presents the results, discussions and interpretation of findings of the secondary data and empirical study. The chapter provides the analysed demographic information, reliability of the study and offers an analysis and discussion on answering the secondary research questions and fulfilling the secondary research objectives. The results of each response category and construct were discussed and interpreted.

Chapter 5: Summary, conclusions and recommendations

The overall concluding remarks and overall dissertation contributions informed by the findings of the empirical research were furnished. The recommendations for the management, industry, private sector, government and policymakers were discussed. The research gaps were noted and clearly indicated for future investigations.

1.12 CONCLUSION

The chapter described the research background, the problem statement, the primary research question, research objectives, the importance of the proposed study, the scope of the study, the assumption, the research layout and dissertation structure. The introductory chapter laid the foundation of the research study and the next chapter dwells on a comprehensive literature review.

2 CHAPTER 2: LITERATURE REVIEW SECTION

2.1 INTRODUCTION

The literature review provides an overview in descriptive format of the published literature, including the most relevant to topics, while clarifying the argument framework. In order to effectively analyse the effects of imports on refractory manufacturing companies, critical literature was reviewed on globalisation, international trade, South Africa's trade balance, the global refractory industry, the refractory industry in South Africa and the factors affecting organisational market performance.

The literature review was split into four sections that were reviewed and critiqued namely:

- **Section 2.1** reviewed globalisation by providing a background, definition, its importance, the merits and demerits including the arguments for and against globalisation.
- **Section 2.2** reviewed and discussed the literature on international trade, Africa's trade and South Africa's trade balance.
- **Section 2.3** discussed and introduced the refractory industry, refractory bricks, global competition within the industry and the refractory end markets.
- **Section 2.4** deliberated on the refractory industry in South Africa, its history, current state, industry trends and the outlook.
- **Section 2.5** discussed the key performance indicators of refractory manufacturers, relating to production, sales and manning levels.

2.2 GLOBALISATION

The term globalisation refers to “the spread of products, technology, information, and jobs across national borders and cultures” (Fernando, 2020). In economic terms, it describes an interdependence of nations around the globe fostered through free trade (Kopp, 2019). According to Eleviu (cited by Cătălina *et al.* 2008:1), globalisation connotes the convergence of markets all around the world to operate as a sole entity. The International Monetary Fund (IMF) defines globalisation as the process through which an increasingly free flow of ideas, people, goods, services and capital leads to the integration of economies and societies (IMF, 2002).

According to Cătălina *et al.* (2008:1), from an economic perspective, globalisation is identified with through following trends:

- Increase in international trade at a much faster rate than the world economy growth
- Increase in international flow of capital including foreign direct investment
- Development of the global financial systems
- Increased role of international organisations that deal with international transactions

2.2.1 The argument on globalisation

Globalisation is subject to vacillating opinions with some believing that it raises the standard of living in poor and less developed countries by providing job opportunities, modernisation and improved access to goods and services. On the other hand, some believe that it destroys job opportunities in more developed and high-wage countries as the production of goods moves across borders (Kopp, 2019).

An overview of the argument was offered by Barna (cited by Cătălina *et al.*, 2008:2). The synthesis of the proponents and opponents' views is detailed as follows:

Proponents of globalisation:

- Globalisation is a stable supporter of the economic growth
- It offers sound support to global trade
- Globalisation and competitiveness are complementary
- It enables maximisation of economies of scale

Opponents of globalisation:

- The tendency to increase income inequality at global level and within countries.
- Results in asymmetric shocks such as social breaks between the rich and the poor, duality of work and unemployment, the duality on lack of power and interdependency.
- A notion exists that globalisation is a potential process of disappearance of the state.
- When fostered through transnational companies, it results in suppressed and even elimination of some national markets.

2.2.2 Benefits for large corporations

The motives of globalisation are idealistic and opportunistic, as the development of the free market has largely benefited large corporations in the Western world, while the impact remains ambivalent in the developed and emerging nations. Large corporations have gained additional competitive advantage through reduced operating costs by manufacturing abroad, procurement of cheaper raw materials, removal of tariffs and the addition of new customers (Kopp, 2019).

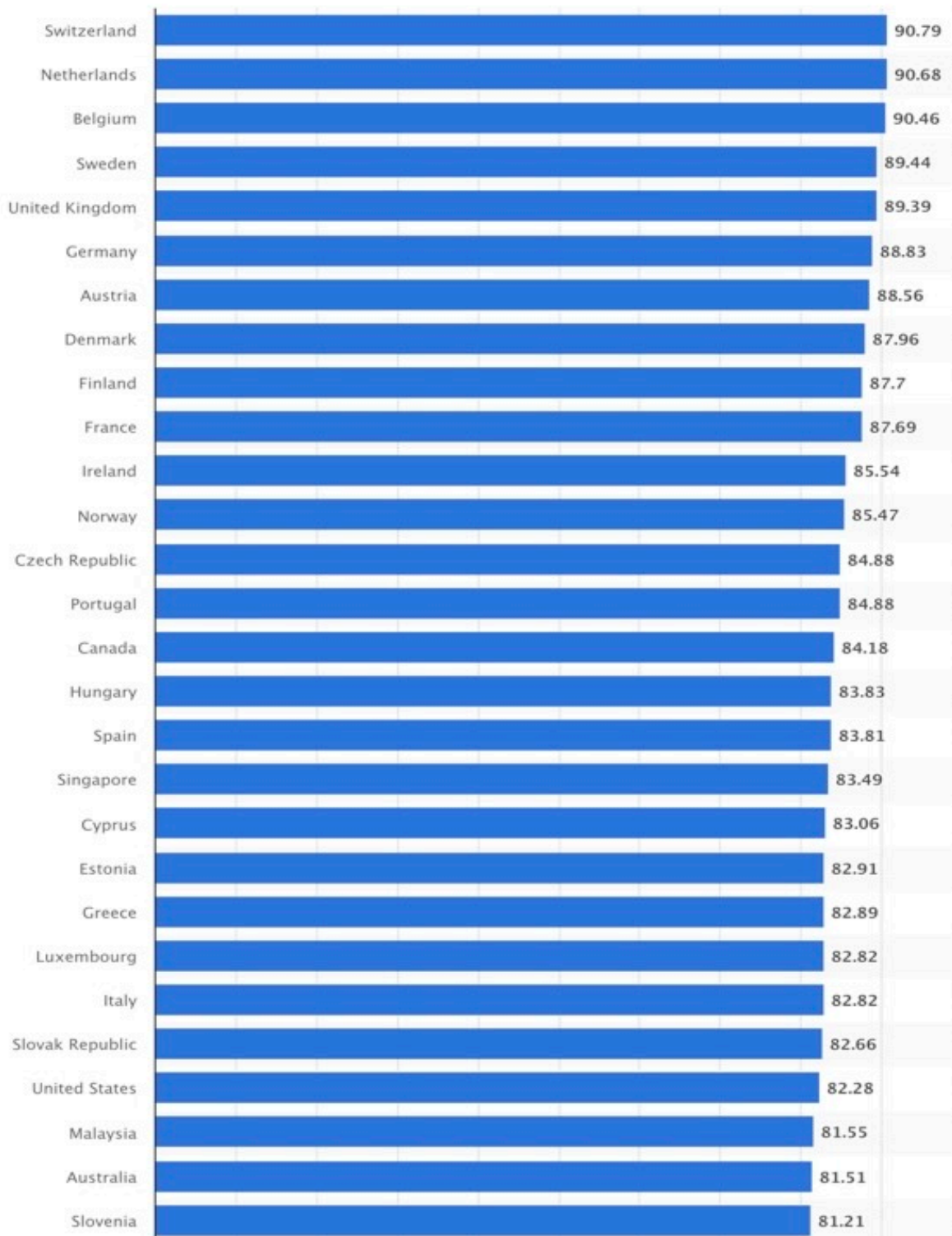
According to Thompson *et al.* (2017:244), the large corporations expand internationally in order to attain the following key advantages:

- To gain access to new customers
- To achieve lower costs through economies of scale and experience increased purchasing power
- To further exploit core competences and capabilities
- To gain access to resources and capabilities located in international markets
- To spread business risk across a wider market base

economical restrictions, data on information flows, common data on personal contacts and data on cultural proximity within the surveyed nations. Globalisation is defined by this index as a process of creating networks of connections among participants at multi-continental distances, mediated through a variety of flows, including people, information and ideas, capital and goods (Szmigiera, 2021). It is the process that erodes national boundaries and integrates national economies, cultures, technologies and complex relations of mutual independence (Statista, 2021).

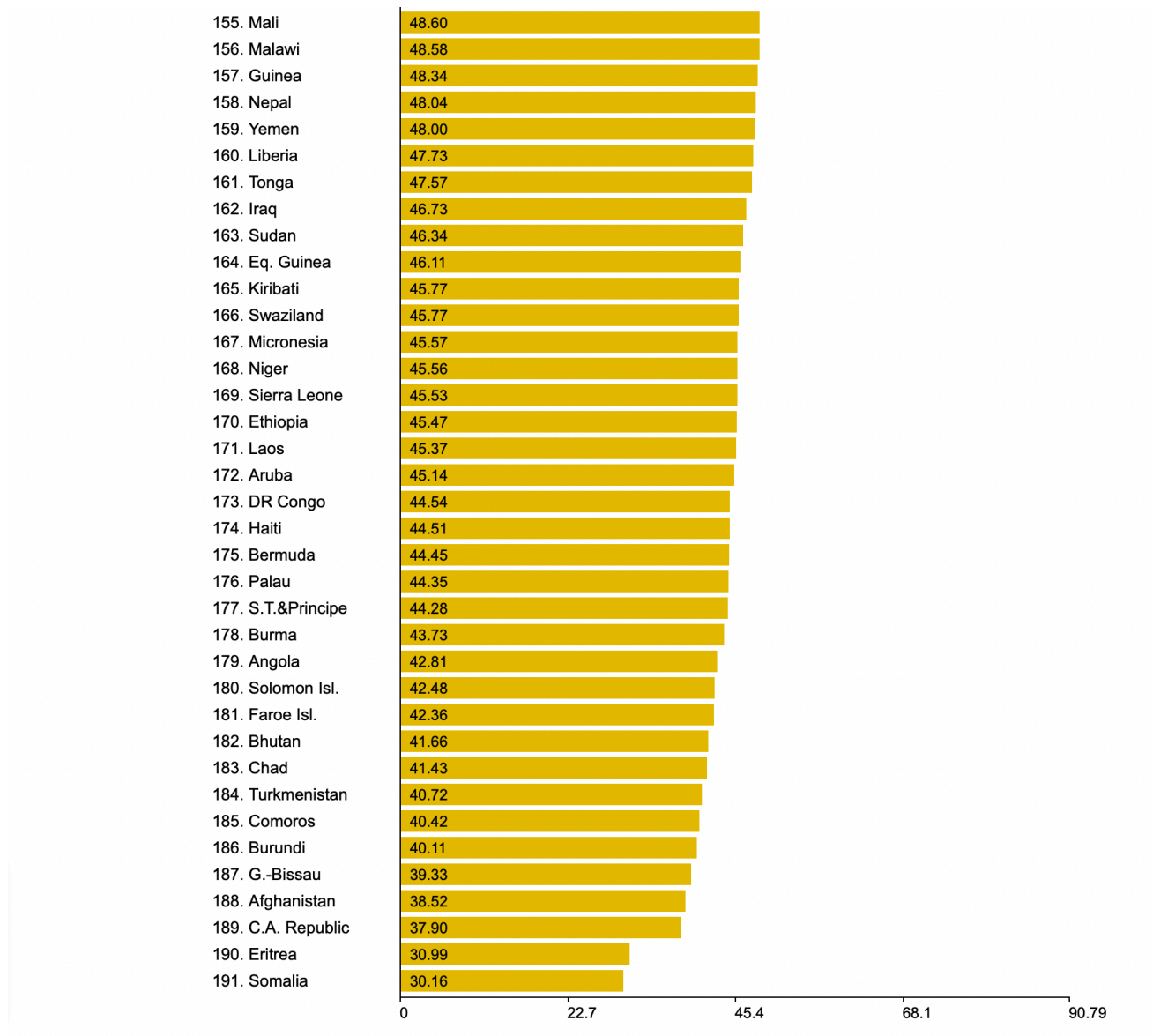
Figure 3 shows the KOF globalisation index for the most globalised nations in 2020 and the least globalised in 2018. The index rating is based on the three dimensions and core sets of indicators of economic, social and political. Switzerland leads with 90.79, followed by the Netherlands, Belgium, Sweden and the United Kingdom. According to the Global Economy (2021), most of the least globalised countries are in Africa and other third world regions. The least globalised country is Somalia, with a KOF index of 30.16, preceded by Eritrea and Central African Republic (The Swiss Institute of Technology in Zurich, 2021). Figure 4 shows the least globalised countries.

Figure 3: List of top globalised countries in 2020



Source: Statista (2021)

Figure 4: The least globalised countries in 2018



Source: The Global Economy (2021)

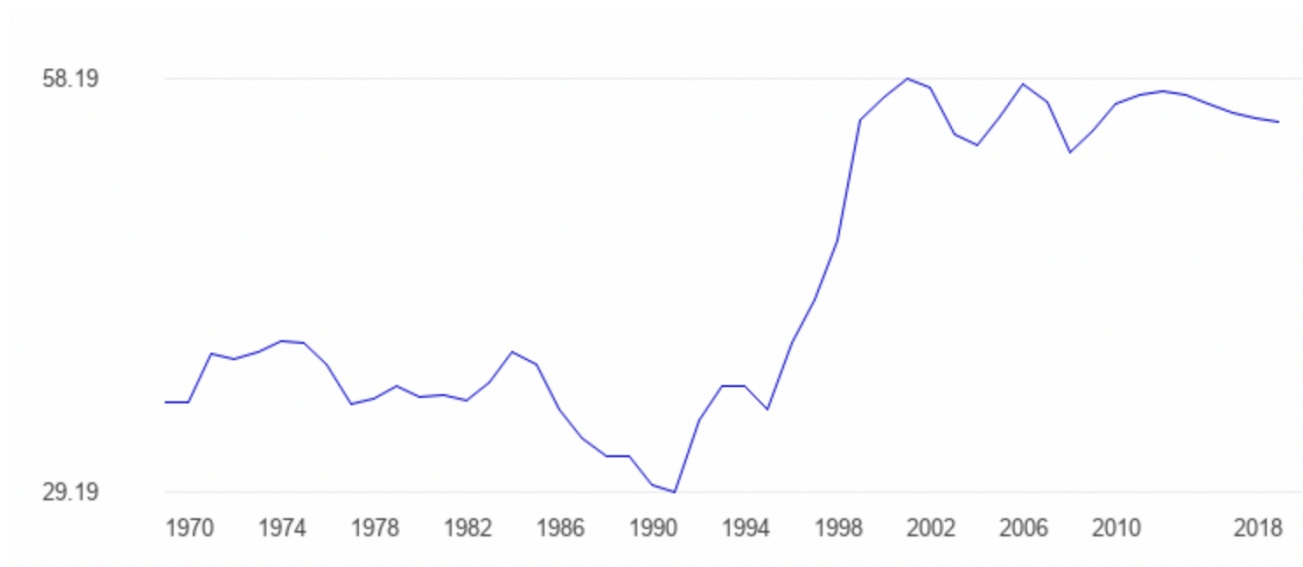
According to the Global Economy (2021), South Africa ranked as the 60th most globalised country ahead of China, Brazil and India among the BRICS Nations. The country's overall KOF index rating stood at 70.51, well above most African countries, apart from Morocco.

2.2.5 KOF economic globalisation index

The KOF economic globalisation index comprises two specific dimensions. The first dimension measures the economic flows of the specific country and the rest of the world based on international trade and international investment. The second metric measures the restrictions to trade and investment (Kılıçarslan & Dumrul, 2018).

Figure 5 presents the KOF economic globalisation index for South Africa from 1970 up to 2018. Significant depressions may be noted in 1990/91 and 2008, while notable growth is depicted from 1995 up to early 2000.

Figure 5: KOF economic globalisation index for South Africa (1970 to 2018)



Source: The Global Economy (2021)

2.3 INTERNATIONAL TRADE

International trade refers to the exchange of goods and services between countries (Heakal, 2021). International trade enables nations to maximise comparative advantages through specialisation, increased productivity and increased output available for consumption (Van Rensburg *et al.*, 2015:475). Proponents of international trade advocate for improved options, increased output and productivity, while the opponents champion the notion of trade barriers such as protectionism.

The concept of free trade supports the promotion of competition and innovation while eliminating monopolies. It is argued that the competition from foreign firms forces domestic organisations to adopt low-cost production techniques, and be innovative in product quality and production methods, and henceforth contribute more to economic growth. Trade links national interests and possess the ability to break the animosity between trading nations, as any political disagreements tend to be settled through negotiations as opposed to war. The

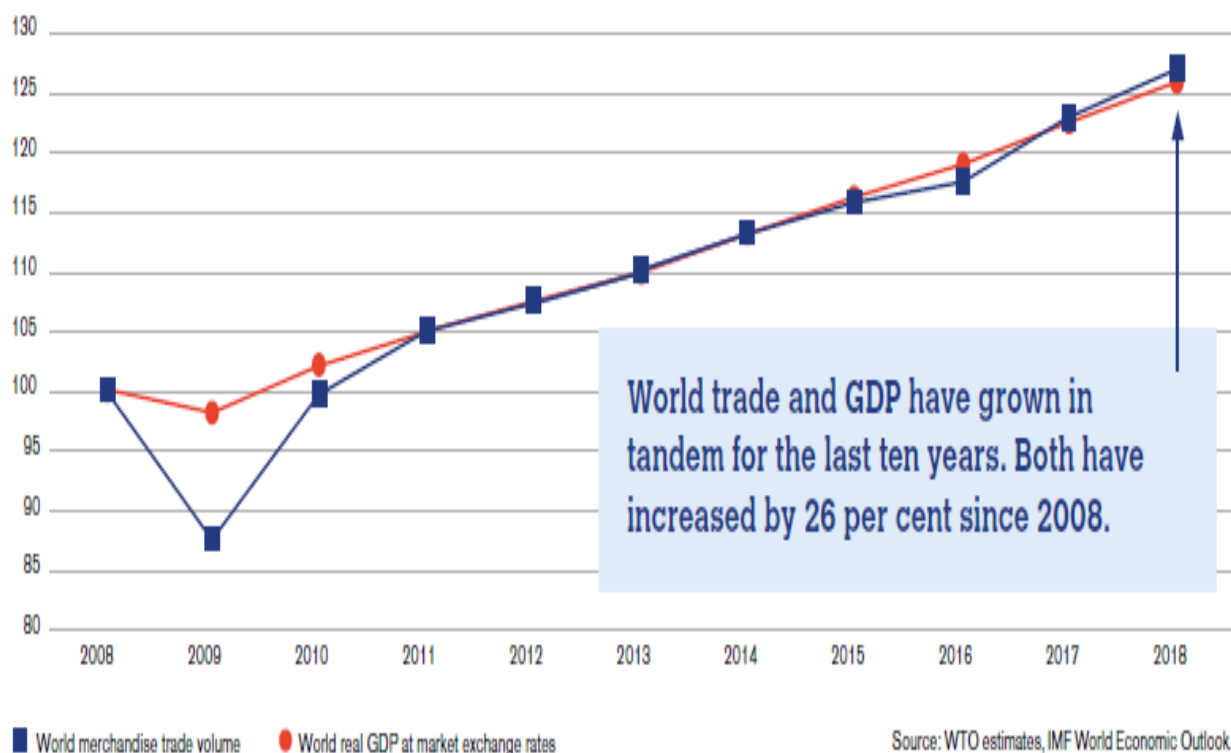
benefits of international trade are immense, including provision and availability of a wider variety of product choices (Van Rensburg *et al.*, 2015:475).

Figure 6 illustrates the global merchandise trade volume and real global domestic product at market exchange rates from 2008 up to 2018.

Figure 6: World merchandise trade volume and real GDP (2008-2018)

World merchandise trade volume and real GDP at market exchange rates, 2008-2018

(Indices, 2008=100)



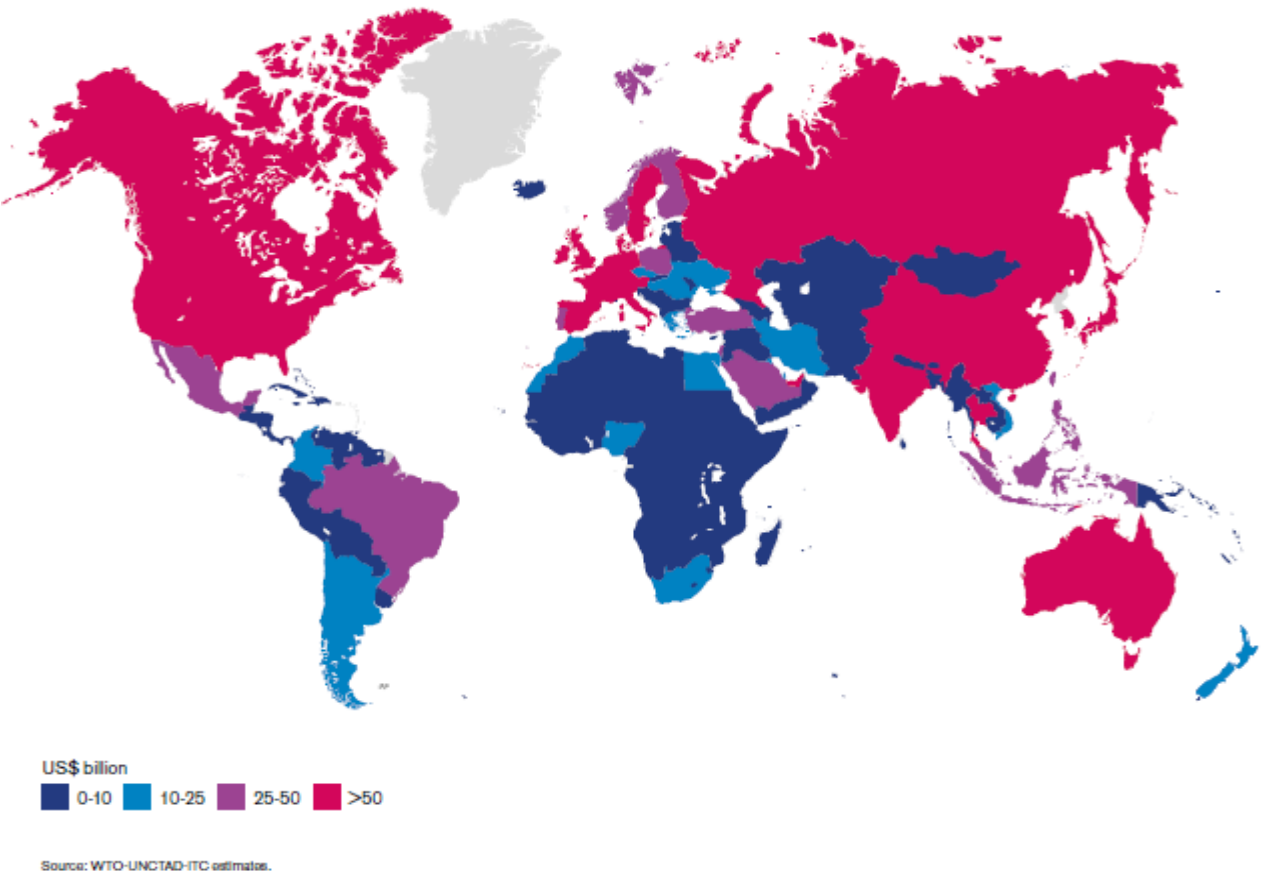
Source: WTO (2019)

According to the World Trade Organization's Statistical Review of 2019, the world merchandise trade volume and global domestic product have grown in tandem for the last ten years by 26 percent since 2008 (WTO, 2019). The positive correlation of world trade and global domestic product is evidence of the increased global economic activity due to international trade.

Figure 7 shows the global economies by the size of trade in commercial services in 2018. It may be noted that the countries with high international trade in commercial services are mostly geographically located in the Northern Hemisphere, except for Australia. Figure 7

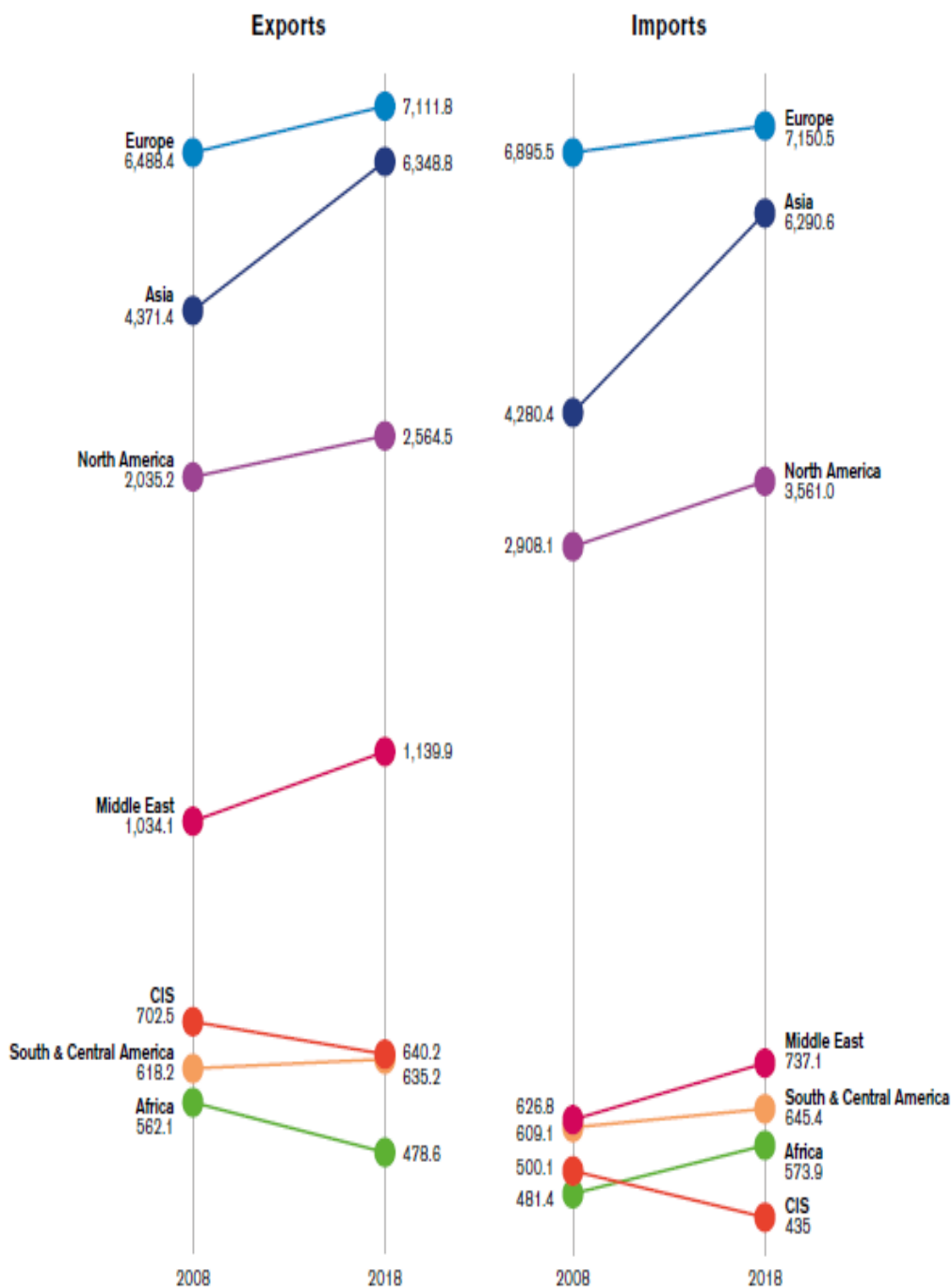
denotes that the top ten traders in commercial services accounted for 53% of the US\$ 5.68 trillion global total in 2018. The largest economic traders in commercial services in Africa comprised South Africa, Nigeria, Egypt and Morocco. All the top African nations traded within the range of US\$10 billion up to US\$25 billion. The remaining 50 African countries are estimated to be trading less than US\$10 billion in commercial services per year.

Figure 7: Economies by size of trade in commercial services 2018



Source: WTO (2019)

Figure 8: Exports and imports by region, 2008-2018 (US\$ billion)



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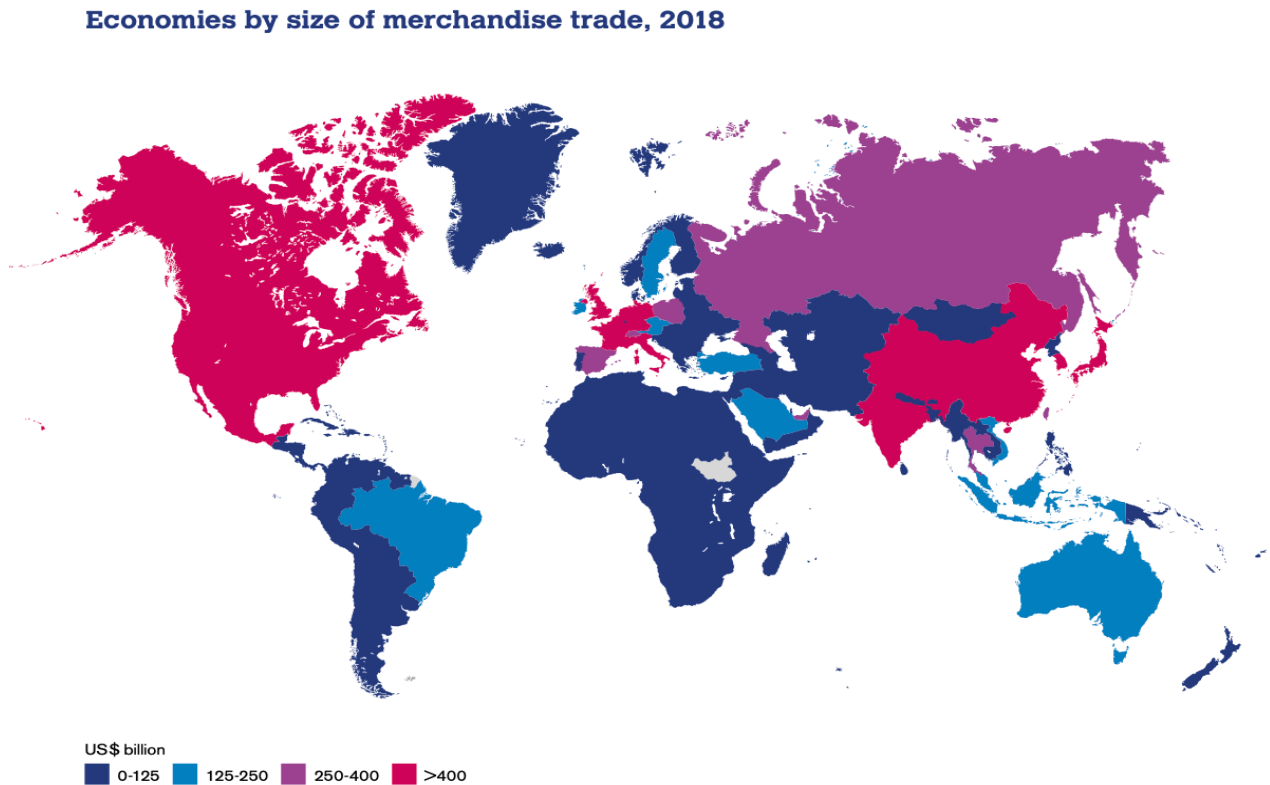
In 2018, Asia's trade flows were 1.5 times higher than its 2008 levels.

Source: WTO (2019)

The top ten trading economies accounted for up to 52% of the US\$19.09 trillion merchandise trade, while the developing economies contributed 44%. The observed phenomenon demonstrates the global trade imbalance among the first world economic powerhouses and the developing economies.

Figure 9 illustrates that African countries accounted for well below US\$125 billion per trading economy on merchandise trade.

Figure 9:Economies by size of merchandise trade,2018



Source: WTO (2019)

One of the biggest challenges and stumbling blocks to promotion of international trade is the frequent imbalance that results in trade deficits in other regions while creating trade booms in other markets.

According to the World Trade Organization's Statistical Review of 2019, the following trends were noted regarding the regional trade statistics from 2008 to 2018 (WTO, 2019).

- Europe moved from a trade deficit of US\$400 billion in 2008 to US\$ 387 billion in 2018, with an approximate 6.5% increase in trade flows.
- Asia moved from a trade surplus of US\$91 billion in 2008 to US\$ 58 billion in 2018, with an approximate 50% increase in trade flows.
- North America moved from a trade deficit of US\$870 billion in 2008 to US\$ 996.5 billion in 2018, with an approximate 23% increase in trade flows.

- The Middle East moved from a trade surplus of US\$91 billion in 2008 to US\$ 58 billion in 2018, with an approximate 50% increase in trade flows.
- South and Central America moved from a trade surplus of US\$9.1 billion in 2008 to a trade deficit of US\$ 10.2 billion in 2018, with an approximate 4.3% increase in trade flows.
- Africa moved from a trade surplus of US\$ 80 billion in 2008 to a trade deficit of US\$95.3 billion in 2018, with a meagre 0.1% increase in trade flows.

It can be noted that, from 2008 to 2018, Asia and the Middle East maintained positive trade balances. North America, Europe, Africa, as well as South and Central America witnessed negative trade balances, respectively. Notwithstanding, Europe reduced its trade deficit while North America, Africa, and South and Central America recorded worrisome and increasing deficits over the period in focus.

In 2018, Asian trade inflows were 1.5 times higher than that of 2008; Asia is booming in trade and manufacturing, the standard of living has improved significantly through provision of job opportunities, modernisation and improved access to goods and services. Nevertheless, the notion of destroyed job opportunities in more developed and high-wage countries as the production factories of goods move across borders also holds (Forbes, 2019). When companies close shop or move across borders, the underlying factors due to increased imports include stiff market competition, reduced sales growth, diminishing market share, reduced capacity utilisation and production output, resulting in higher unemployment. This trend further corroborates the premise and notion that globalisation is in fact detrimental to some of the developing countries and emerging economies.

2.3.1 Developing economies of trade

According to Kaya (2007), globalisation of the less developed countries varies depending on the role they play in international trade and foreign direct investment. The historical waves of economic globalisation had a remarkable impact on the industrialisation and social class structures of less developed countries. The countries with prominence of exports of manufactured goods experienced expansion of low-skilled labour classes, while those with significant amounts of foreign direct investments in combination with significant exports experienced growth of skilled labour classes (Kaya, 2007).

The African continent contributed 2.5% to global exports and 3% to global imports in 2018 on merchandise, demonstrating 20% trade deficit (WTO, 2019). Figure 10 below shows the merchandise trade for developing economies in 2017 and 2018.

Figure 10: Developing economies' merchandise trade by region (US\$ billion)

	Exports					Imports				
	Value	Share in world		Annual % change		Value	Share in world		Annual % change	
	2018	2017	2018	2017	2018	2018	2017	2018	2017	2018
Developing economies ^a	8,223	43.2	43.5	12	11	7,974	40.7	41.1	13	12
Latin America	1,086	5.8	5.7	12	9	1,122	5.8	5.8	8	11
Developing Europe	205	1.1	1.1	11	9	279	1.6	1.4	17	-1
Africa	479	2.4	2.5	18	14	574	2.9	3.0	6	11
Middle East	1,140	5.5	6.0	15	21	737	4.2	3.8	3	1
Developing Asia ^a	5,314	28.4	28.1	11	9	5,262	26.2	27.1	16	14
Memorandum items:										
World ^a	18,919	100.0	100.0	11	10	19,394	100.0	100.0	11	10
Developed economies	10,056	53.8	53.2	9	9	10,984	57.1	56.6	9	9
Commonwealth of Independent States, including associate and former member states	640	3.0	3.4	25	24	435	2.3	2.2	22	8

Source: WTO (2019)

The commercial services portion consisted of 1.9% of global exports and 3.1% global imports in 2018 on merchandise, demonstrating approximately 50% trade deficit (WTO, 2019). Figure 11 provides detailed evidence of the level of commercial services trade in developing economies.

Figure 11: Developing economies' commercial services trade by region

(US\$ billion and percentage change)

	Exports					Imports				
	Value	Share in world		Annual % change		Value	Share in world		Annual % change	
	2018	2017	2018	2017	2018	2018	2017	2018	2017	2018
Developing economies	1,781	30.4	30.9	9	9	2,097	38.0	38.2	7	8
Latin America	187	3.4	3.2	6	2	218	4.2	4.0	7	1
Developing Europe	66	1.1	1.1	17	12	33	0.6	0.6	11	3
Africa	112	1.9	1.9	15	10	170	2.9	3.1	11	13
Middle East	219	3.9	3.8	8	5	300	5.5	5.5	5	6
Developing Asia	1,197	20.1	20.8	8	11	1,376	24.7	25.1	7	9
Memorandum items:										
World	5,770	100.0	100.0	8	8	5,485	100.0	100.0	6	7
Developed economies	3,871	67.7	67.1	8	7	3,244	59.3	59.1	5	7
Commonwealth of Independent States (CIS), including associate and former member States	117	2.0	2.0	13	12	144	2.6	2.6	15	7

Source: WTO (2019)

The observed trend of results is proof of the ambivalence and vacillating opinions of society, economists, technocrats and social scientists on global trade.

According to Eravworke and Imide's (2013) research, international trade is an engine of growth in developing countries (*A Case Study of Nigeria*). A review of the literature revealed that countries that are more open to international trade tend to experience higher economic growth rates and per capita income than countries that do not trade or close the economy. The investigation concluded that the Nigerian government should consider exporting more goods and services in order to promote international trade, which is a veritable tool for economic growth.

According to Sinha and Sinha's (cited by Eravworke & Imide, 2013:49), research on a cross-section and role of balanced trade (export minus imports), to illustrate the role of international trade on economic growth and development. The investigation identified a positive relationship between economic growth and export trade to imports (X-M) / (GDP).

An empirical investigation by Mogoe and Mongale on the *Impact of International Trade on Economic Growth in South Africa: An Econometrics Analysis* revealed that inflation rate, export and exchange rates are positively related to GDP, while import is negatively related to GDP. This study recommended that the policymakers should improve and strengthen the competitiveness of export sector with the aim of striving for a balance with the import sector (Mogoe & Mongale, 2014).

Scott *et al.* (2018) researched on the impact of plurilateral trade agreements on developing countries such as Chile, Bangladesh, Malawi, South Africa, Lesotho and India. The qualitative analysis findings concluded that policymakers are generally disinterested in PTAs because they are generally misaligned to their respective country's economic interests and often threaten the policy space. The quantitative analysis results revealed that gains could be made from additional active participation in these agreements that promote international trade. Among the interviewed people, none were able to support their opinions quantitatively, which concludes the insufficient, concrete analysis of policy-makers.

The lack of quantitative research can be attributed to a combination of concerns and constraints. Countries such as Malawi and Lesotho, for example, currently lack the technical and financial capacity required to play a meaningful role in PTA-related research and negotiations. Bangladesh is similarly affected, although to a lesser extent, while South Africa is particularly concerned about the intrusion into its policy space that active participation in PTAs would entail. Of the six countries investigated, Chile displayed the greatest acceptance of PTAs, but it, too, is preoccupied with preserving policy space in order to drive growth and development in key economic sectors (Scott *et al.*, 2018).

The desire to protect policy space has strong political undertones and should not be downplayed. While developing countries should be given the necessary freedom to protect and build competitiveness in their infant industries, the problem with the policy space argument is that numerous countries such as South Africa tout it as a generic reason for resisting trade reform. As a result, trade agreements that might have reasonable potential (such as, in South Africa's case, three of the four PTAs covered in this study) are not even considered owing to preconceived notions about the need to look after the interests of sectors.

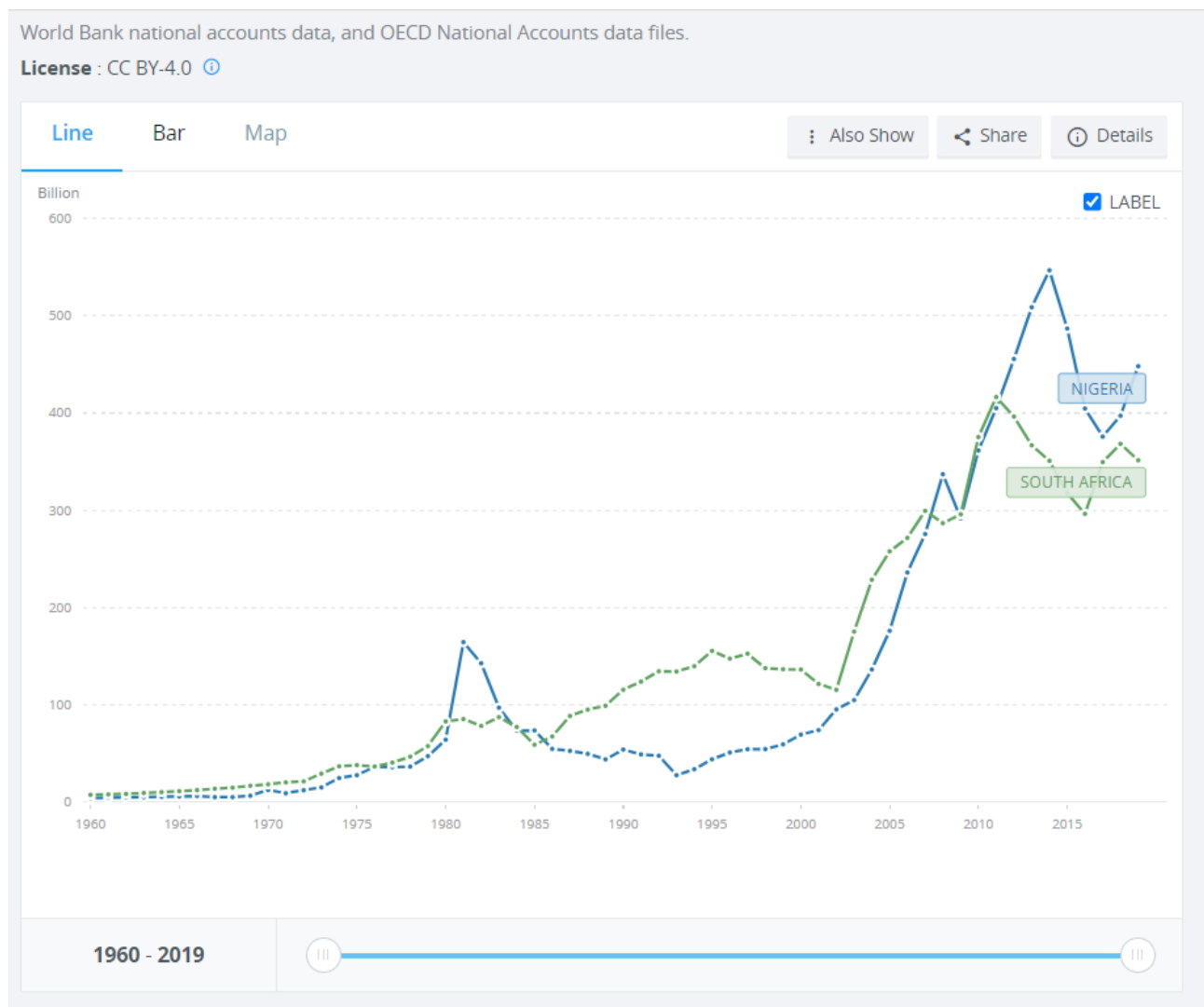
If more people in these countries were made aware of what they could gain from participation in these agreements, they might reconsider the assumed need for generous policy space,

which often flies in the face of greater trade liberalisation. PTAs, besides providing market access benefits to exporters, constitute a vehicle for participating countries to gain from the liberalisation of individual sectors (such as services or technology goods), which, in turn, can aid the local development of such sectors while also providing an additional stimulus to the economy as a whole. It may be concluded that exports are favourable and beneficial for developing economies, while imports and negative trade balances are negatively related to GDP.

2.3.2 South Africa's trade balance

The Republic of South Africa ranks as the second largest economy in Africa after Nigeria (World Bank, 2021). As the continent's second largest economy, South Africa's trade and economic activities have a significant impact on the continent's overall economic performance and balance of trade. With a gross domestic product (GDP) of USD350 billion in 2019, South Africa represents 0.29 percent of the world economy and approximately 14% of the Africa's GDP (IMF, 2019). Figure 12 below illustrates South Africa and Nigeria's respective GDPs from 1960 up to 2019.

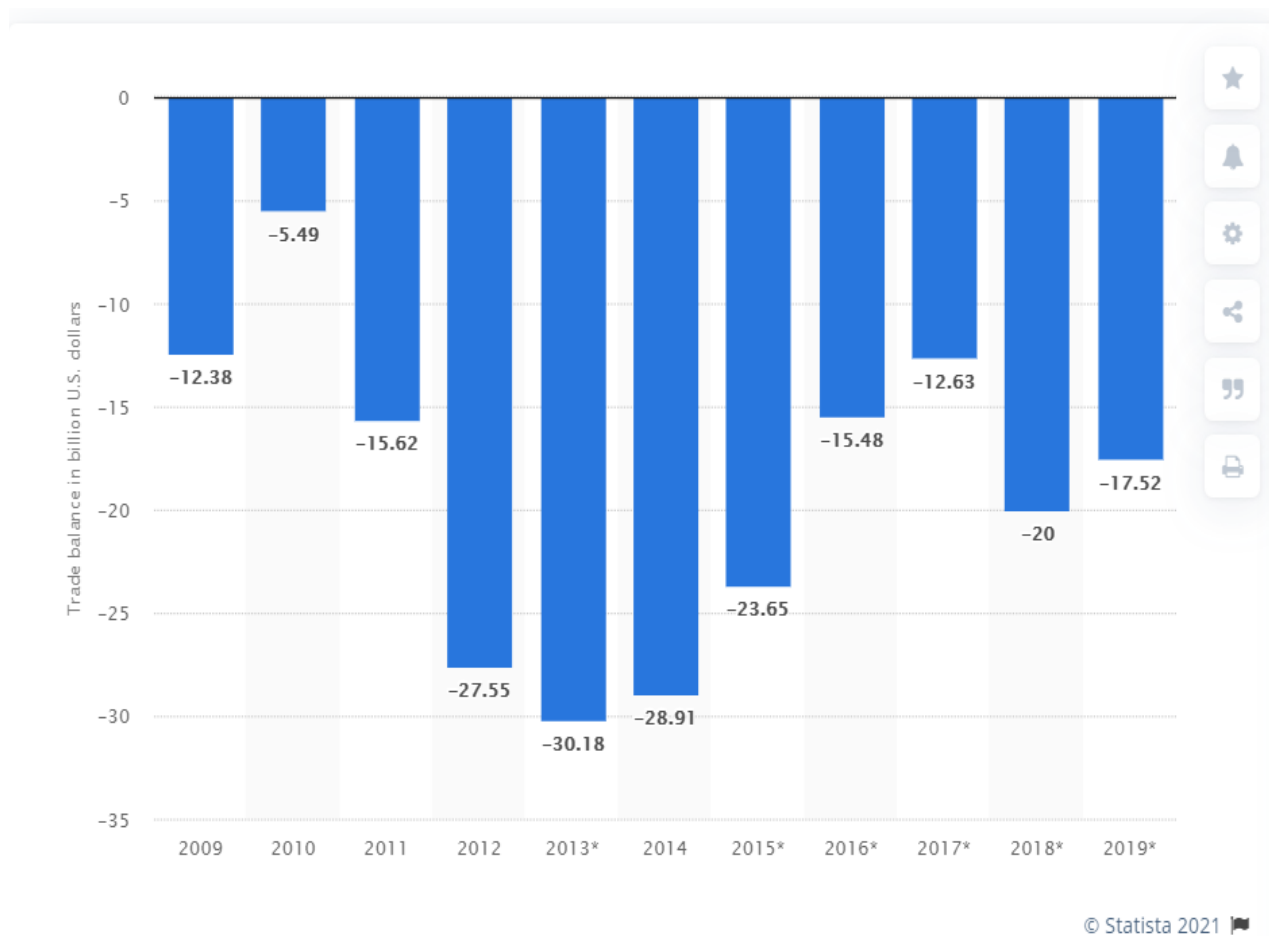
Figure 12:South Africa and Nigeria's GDP from 1960-2019



Source: World Bank,2021

The statistics in Figure 13 show that South Africa's trade balance from 2008 to 2018 recorded a minimum of minus US\$30.8 billion to a maximum of minus US\$5.5 billion. The average trade balance was US\$21.20 billion in the negative. In 2018, South Africa's trade deficit amounted to around 19.63 billion U.S. dollars (Statista, 2020).

Figure 13: South Africa: Trade balance 2008-2019 (US\$ billion)



Source: Stats SA (2021)

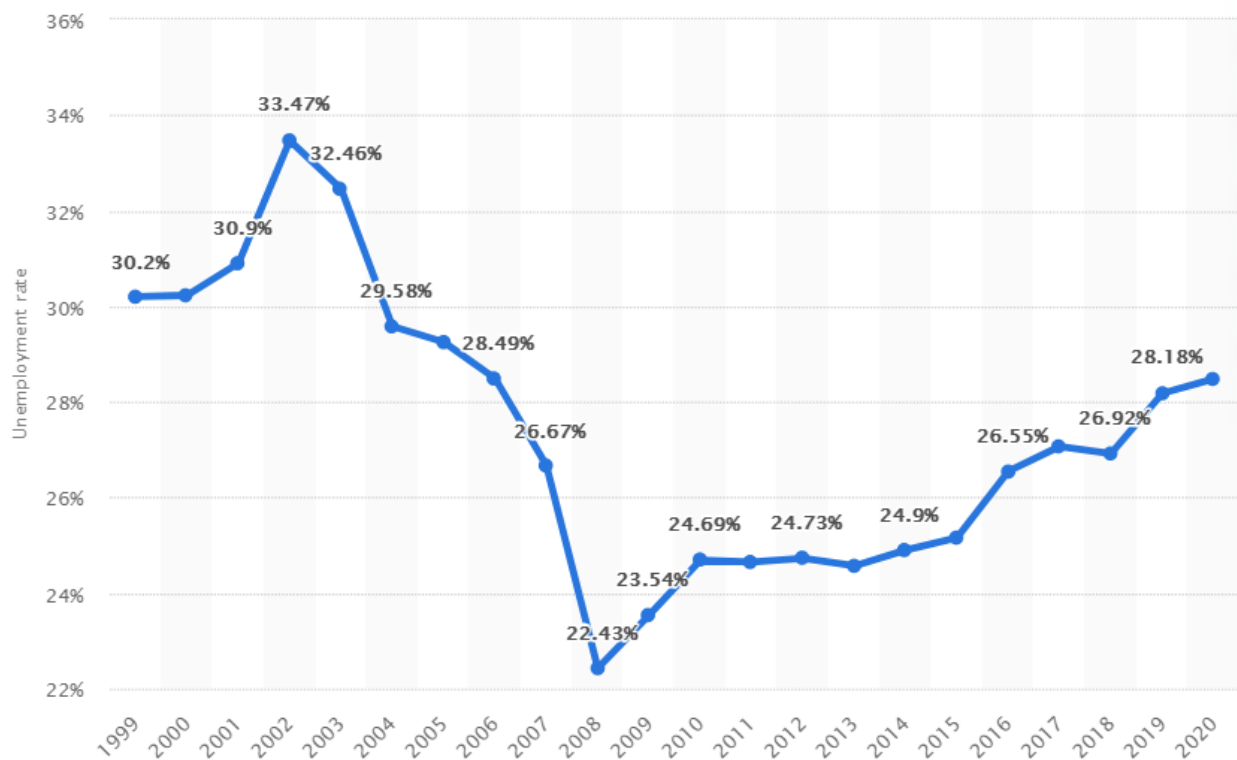
With the foregoing in mind, it is worth noting that the deficit of trade balance is representative of both merchandise and commercial services. According to Mogoe (2014), imports have a negative influence on GDP. The trade deficit is indicative of the general South African economy and reflective of greater imports into the country. It may be concluded that the trade deficit clearly indicates the presence imports across the manufacturing spectrum that result in stiffer competition for the local manufacturing firms. The refractory manufacturing industry in South Africa has not been spared by the effects of global imports (du Plessis, 2015).

According to Imbs (2013), there is evident deindustrialisation of the South African economy, suggesting that trade, both local and global, contributes to the structural change from manufacturing to services. Deindustrialisation refers to the contraction in weight of the manufacturing industry within an economy (Pike, 2009). Deindustrialisation is measured in terms of output or total valued produced per sector and employment of the sector.

It may be argued that the current unemployment rates in South Africa corroborates the premise of deindustrialisation as the structural shift to services does not support more employment and tends to have a lean structure. Structural unemployment is the biggest contributor to unemployment in South Africa. While the major cause of structural unemployment might be attributed to the lack of skills in the general populace, it is worth noting that highly skilled professional also struggle to secure employment due to structural unemployment imposed by declining demand for their skills (Van Rensburg *et al.*, 2015:375).

The figure 14 below shows the unemployment rate in South Africa from 1999 up to 2020.

Figure 14:South Africa's unemployment rate from 1999 to 2020



Source: Stats SA (2021)

The period from 2008 up to 2020 witnessed a gradual increase in the unemployment rate from 22.43% up to 28.18%, respectively.

2.4 REFRACTORY BRICK TRADE

The world trade for refractory bricks declined in 2019 from US\$4.71 billion to US\$4.38 billion. The refractory brick trade represents about 0.024% of the total world trade. Table 2 below illustrates the overall refractory brick statistics for 2019.

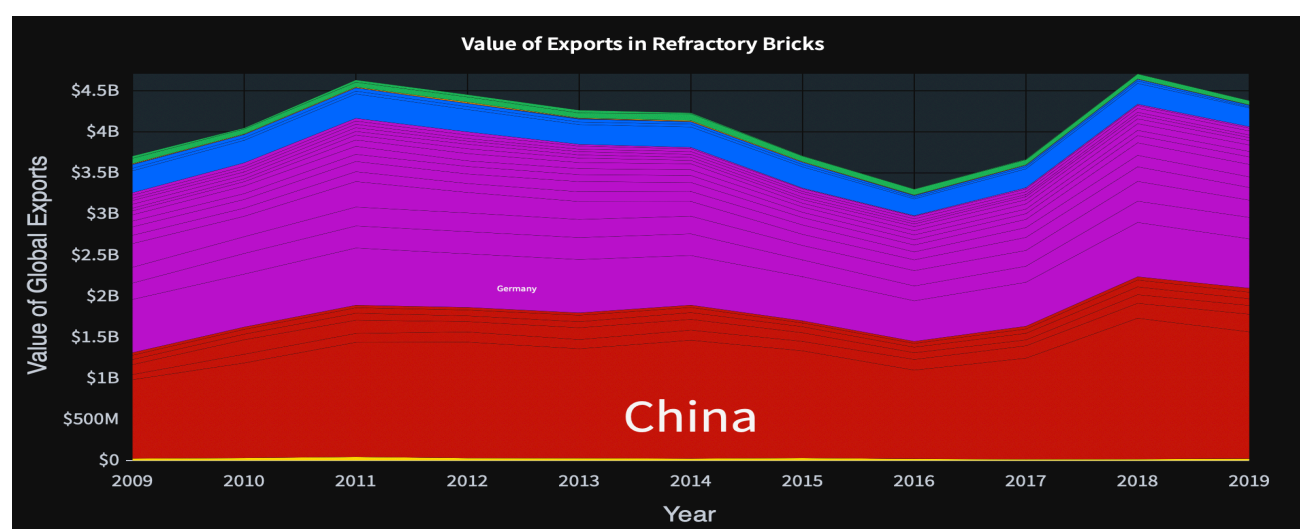
Table 2:Refractory bricks data

Refractory bricks data					
World trade 2019	Top exporter	Top importer	Mean tariff	Share of world trade	
US\$4.38 billion	US\$1.54 billion	US\$287 billion	6.35%	0.024%	

Source: OEC (2021)

Figure 15 provides the historical data on refractory bricks from 2009 up to 2019. Based on this graph, it may be noted that China and Germany are the major players in export of refractory bricks.

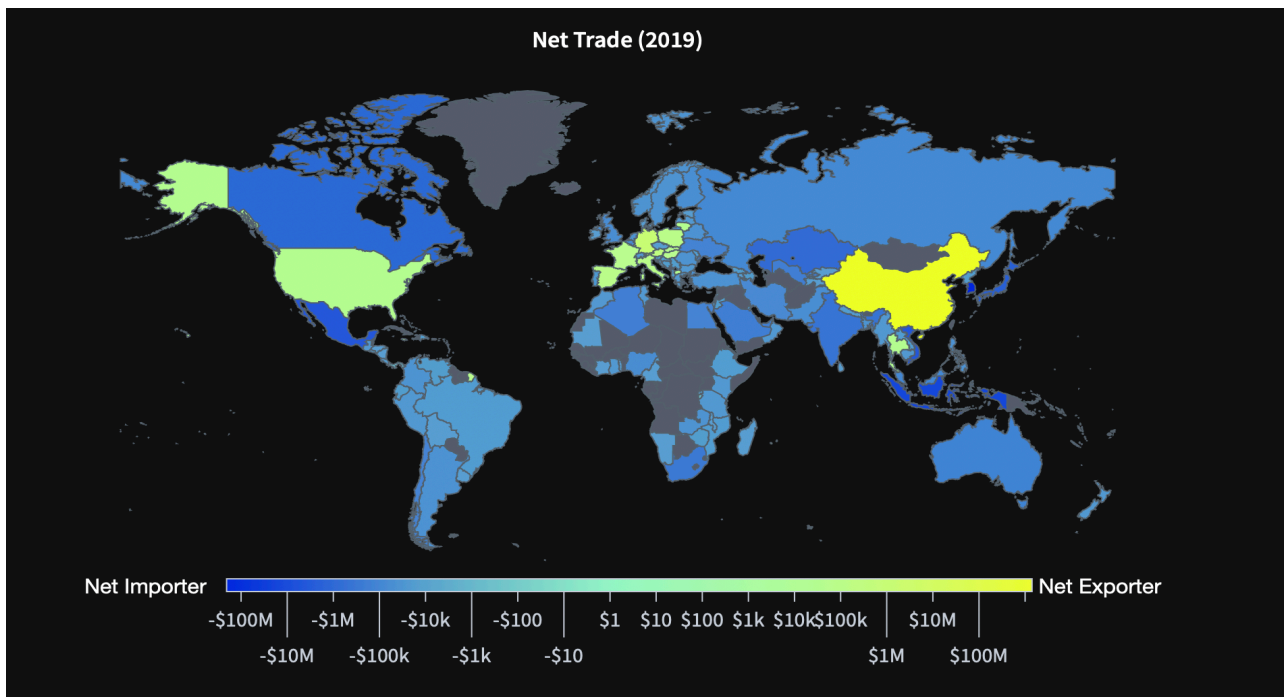
Figure 15:Value of exports in refractory bricks



Source: OEC (2021)

The map below (Figure 16) shows a comparison of the countries that export and import refractory bricks, with each colour based on the difference in export and imports in 2019 (OEC,2021). It may be noted that China, the USA, Spain, Italy, Germany and other European countries are the major net exporters of refractory bricks. The bulk of the global community are net importers, including Australia, South Africa, Brazil and Canada.

Figure 16: Net trade of refractory bricks in 2019



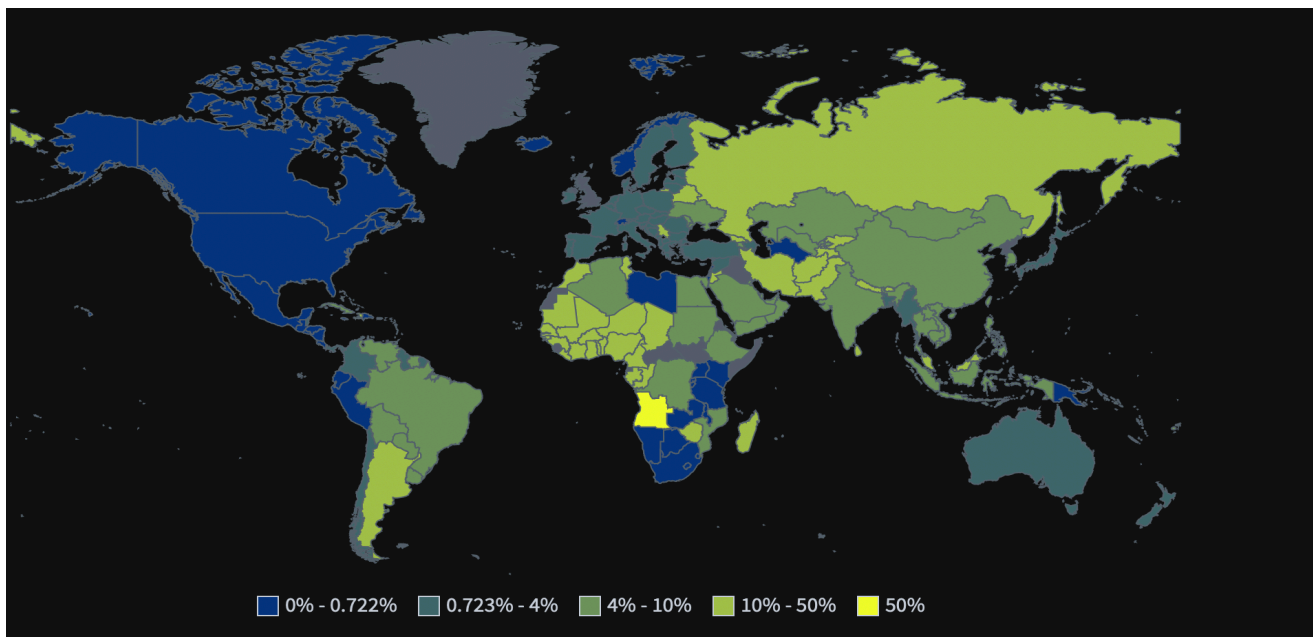
Source: OEC (2021)

According to the OEC (2021), South Africa is the largest exporter and importer of refractory bricks in Africa, comprising 59.1 percent of exports equivalent to US\$14 million and 22.1 percent of exports at US\$77.1 million.

One of the most widely used control measures for restricting imports is protectionism such as high import tariffs. According to OEC (2021), the mean global tariffs on refractory bricks were 6.35%, with the highest recorded in Angola at 50 percent, the Bahamas at 29.4 percent and Sri Lanka at 25.6 percent. South Africa's tariffs on refractory brick imports range from 0 to 0.722%, which is very low and well below the mean global tariffs for refractory bricks. It is worth noting that the countries with higher exports in refractory bricks such as China, Germany and Brazil, possess higher tariff fees on imports compared to South Africa.

Figure 17 provides pictorial data on the refractory brick tariffs of the world economies.

Figure 17: World tariffs for refractory bricks



Source: OEC (2021)

2.5 THE GLOBAL REFRACTORY INDUSTRY

Refractory materials are defined as a group of technical ceramics, which can withstand heat, chemical attack, abrasion, thermal shock and rough handling, and are commonly utilised in the containment of hot or molten material during processing and transportation (Hloben, 2000:10). Refractories are utilised for a range of applications including metal smelting, mineral processing, power generation, petrochemical and in various industries such as iron and steel, aluminium, glass, copper smelting, ferrochrome, cement production, paper and pulp and other non-ferrous metals (Dickinson Group, 2021).

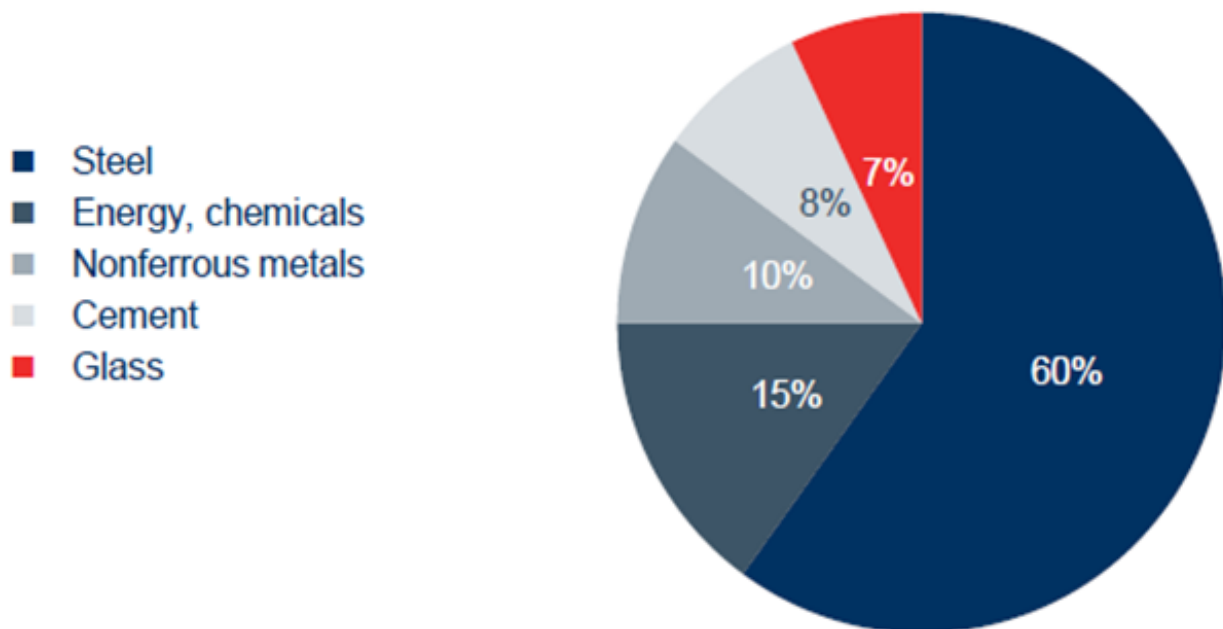
The global refractories market size was over USD 30 billion in 2018 and is expected to witness an annual growth of more than 4% between 2019 and 2025 (RHI Magnesita, 2019). Strong product demand from aerospace, electrical, automotive, glass, cement industries is expected to drive refractories market size globally over the next five years (World Refractories, 2021).

2.5.1 Refractory end markets

Numerous suppliers manufacture bricks and monolithic refractories that are consumed in various industries such as iron, steel, cement, glass, non-ferrous metals, and ceramics. Among these end markets, steel is the most predominant consumer, with 60 percent of the

total market share (Beroe,2021). The pie chart below denotes the typical consumption market share of refractories in the various industries such as steel, energy, chemicals, glass and cement

Figure 18: Refractories markets

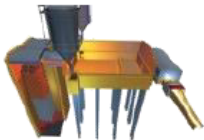


Source: RHI Magnesita (2019)

Refractories are either considered consumable goods, which must be continually replaced (as in steel making) or investment goods, where the materials are replaced less frequently (as in glass furnaces or reformers for the energy industry). Although it is critical to manufacturing, refractories represent less than 3% of cost of goods sold (COGS) in steel manufacturing and less than 1% in other applications (RHI Magnesita, 2019).

Figure 19 shows the typical industrial applications for refractories, the replacement frequency and associated costs.

Figure 19: Typical industrial applications for refractories

Key industries	Applications	Replacement	Costs
Steel	Basic oxygen-, electric arc furnace casting ladles 	20 minutes to 2 months	~3.0%
Cement/Lime	Rotary Kiln 	Annually	~0.5%
Nonferrous metals	Copper-converter 	1 – 10 years	~0.2%
Glass	Glass furnace 	Up to 10 years	~1.0%
Energy/ Environmental/ Chemicals	Secondary reformer 	5 – 10 years	~1.5%

Source: RHI Magnesita (2019)

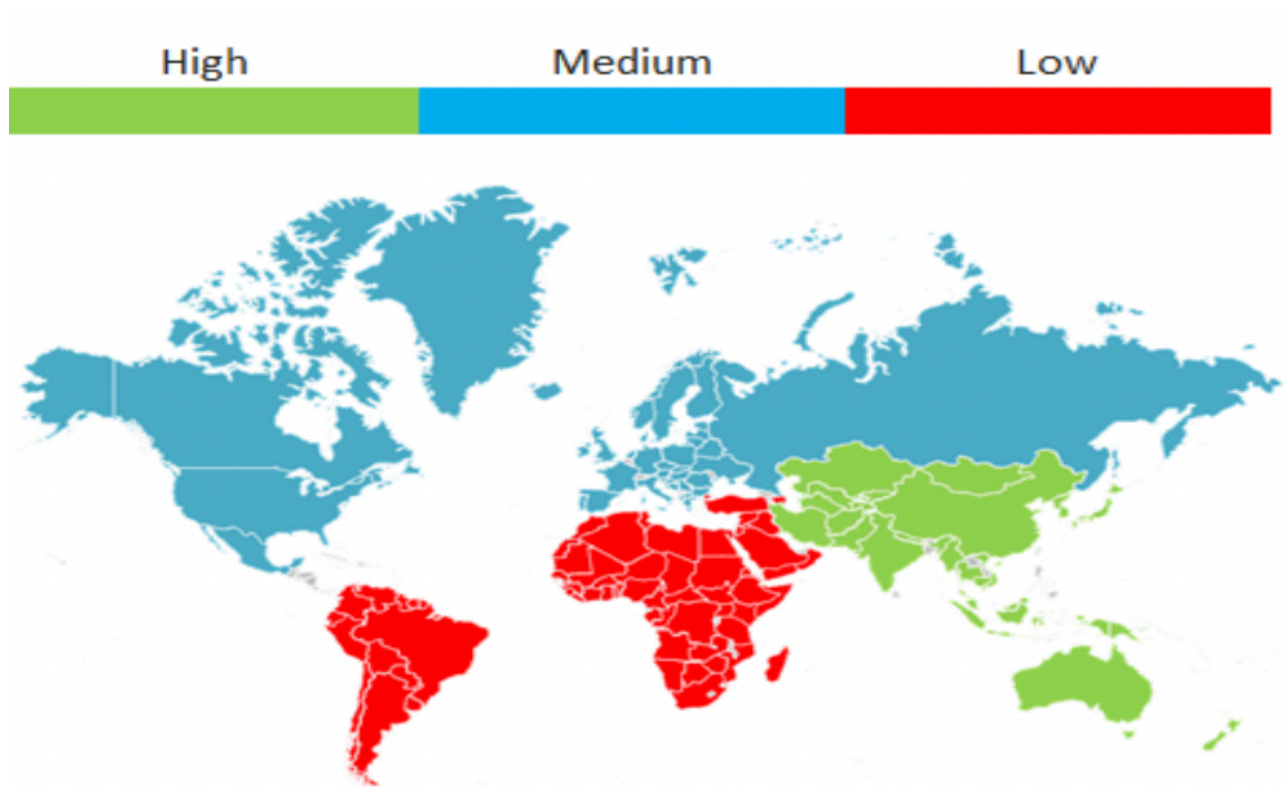
2.5.2 Refractory applications

Refractories are mainly utilised by the metallurgical industry in the internal linings of furnaces, kilns, reactors and other vessels for holding and transporting metal and slag. In non-metallurgical industries, the refractories are mostly installed on fired heaters, hydrogen reformers, ammonia primary and secondary reformers, cracking furnaces, incinerators, utility boilers, catalytic cracking units, coke calciner, sulphur furnaces, air heaters, ducting, stacks, rotary kilns, preheaters and ovens. Most of these vessels operate at elevated furnace temperatures in excess of 1 500°C, as a result of the high melting point of metals such as steel, nickel and copper. The refractory materials are required to withstand temperatures well over and above these temperatures (CRE, 2020).

2.5.3 Global refractory supply chain

The major producers of refractory raw materials include China, India, South America, Australia, Eastern Europe, Japan and the United States of America (USA). The People's Republic of China accounts for more than 60 percent of the total refractory volumes. The consumption of refractories is very high in Asia, Europe and North America, in comparison to South America and Africa (Beroe,2021). The below diagram shows the typical refractory consumption by continent.

Figure 20: Refractory consumption by continent



Source: Beroe (2021)

The price of refractory materials mainly depends on the four parameters of raw material, fixed, utility and labour costs. The fixed and utility are microeconomics variables, while the raw material and labour vary in accordance with supply and demand. Pricing for refractories can be locked on input cost (raw material cost plus contracts). Moreover, a cost-plus incentive contract is established when the supplier is proactively engaging in technology that increases the life of a refractory product (Beroe, 2021).

Figure 21: Producer price index of refractory materials (1999 to 2021)



Source: Fred (2021)

According to Fred (2021), the producer price index for refractories illustrates the continual price increase of the end products. This poses additional pressure to the manufactures as the have to renegotiate the price increases with consumers while competing with global players.

2.5.4 Global competitors

The global refractory manufacturing industry comprises large corporations that exhibit international growth strategies for accessing new customers, achieving low costs through economies of scale, increasing purchasing power, further exploitation of core competences, accessing resources and capabilities located in international markets and spreading business risk across the wider market base. The top five major players cater for about 34 to 35% global market share (Mordor Intelligence, 2021).

The global refractory industry consists of the following major players:

- RHI Magnesita (United Kingdom)
- Vesuvius (United Kingdom)
- Krosaki (JP) incl. TRL (India)
- Shinagawa (Japan)
- Magnezit (Russia)

- Harbisonwalker International (United States of America)
- Morgan (United Kingdom)
- Chun (Korea)
- Puyang (China)

According to Mordor Intelligence (2021), the refractories market concentration may be described as fragmented, denoting a highly competitive market without dominant players.

2.5.5 Classification of refractory materials

Refractories can be classified in numerous ways, with the two most prevalent being on the basis of composition (chemical behaviour i.e. their reaction to the type of slags – acid, basic & neutral) and on the basis of form (Shaped & Unshaped). Other methods to classify the refractory materials are on the basis of their functional service temperature, for example 1 800°C castables.

The categorisation based on form or configuration or visible shape, distinguishes between monolithics (unshaped) and shaped refractories. The range of shaped refractories comprises of dense bricks, fusion cast, ceramic fibre products, insulation firebricks and speciality shapes. Monolithics or unshaped refractories mainly comprise castables, gunnables, rammables, fettling materials, plastics, mouldables, mortars and pumpables (Holben, 2000:12). The figure below details the types of refractories based on form.

Figure 22: Types of refractories based on form

SHAPES	MONOLITHICS
Dense Bricks	Castables
Fusion Cast Shapes	Gunning and Shotcreting Materials
Ceramic Fibre Products	Pumpables
Insulation Firebricks	Rammables
Speciality Shapes	Fettling Materials
Precast Shapes	Mortars and Fillers
Crucibles	Plastics and Mouldables

Source: Hloben (2020)

For the purpose of this research study, the author limited the scope of literature to the shaped refractories or bricks

- **Dense bricks**

Dense bricks are the most common type of shapes and a critical component for refractory linings. Dense bricks have evolved from a standard rectangular brick form to a wide variety of shapes designed to fit specific furnace structures. The standard rectangular brick is a useful form to build straight walls. Other forms are required for the arch of a furnace or other curved designs. Standard tapered bricks, called arches, keys and wedges are produced for these applications. Dense bricks are manufactured as fired, chemically bonded unfired and pitch or resin bonded (tempered). The raw materials are mixed with a binder, which can be clay, phosphate, silicates, etc. The brick mixture is then pressed, rammed, cast or extruded. After drying, the bricks are fired to high temperatures (1200 to 1700°C) to form a fired bond between particles or are tempered (300 to 500°C) to remove organic volatile material (CRE, 2020).

- **Insulation bricks**

Insulation bricks are usually made of fireclay and high alumina, and are manufactured to contain more than 45% pores. This assures a low thermal conductivity that is required for proper insulation. Insulation bricks are made by two general processes. In one, incorporation of a combustible material such as coke breeze or saw dust is used. The combustible material added to the composition mix burns out during firing leaving porous spaces, which results in low density (high porosity). In the other process, natural lightweight materials such as vermiculite, perlite and diatomite are used or the refractory may contain foaming agents to lower the density of the finished product. Insulation firebricks are produced in a range of compositions available commercially with refractoriness up to 1 815°C (CRE, 2020).

2.5.6 Production of refractory bricks

The production process of refractory bricks entails the following production stages (CRE, 2020):

- Preparation
- Mixing
- Shaping
- Pressing or vibrating drying
- Firing or tempering

- **Preparation**

The preparation stage includes crushing, milling and screening. The crushing process is conducted in two or more stages in order to obtain various grain sizes. The appropriate crushing equipment is selected according to hardness and viscosity of materials to be processed. A set of vibrating screens, with differing mesh sizes, are used to separate the crushed material to desired grain size fractions.

- **Mixing**

There is hardly any refractory material that consists of one raw material and one grain size fraction. Therefore, a mixing process is necessary to achieve the right chemistry, rheology and homogeneity of the mix. The mixture of raw materials is a part of expertise, an asset and therefore is a carefully guarded secret of the manufacturer. Raw materials, binders and additives are fed into a mixer in a certain order and subsequently homogenised charge by charge, usually in discontinuous mixers. With that, a mix for shaping is obtained. The grading of the mix strongly determines the physical properties. As a rule, four grain size fractions are mixed; these are coarse, medium, fine and very fine grain. Counter flow and double shaft mixers, rapid mixers as well as pug mills with a high muller weight have proved best for homogenisation. Whether to use a mixer or a pug mill is determined by the desired physical properties of the mix for shaping. In the production of monolithic materials, the manufacturing process ends here, followed by packing and dispatch.

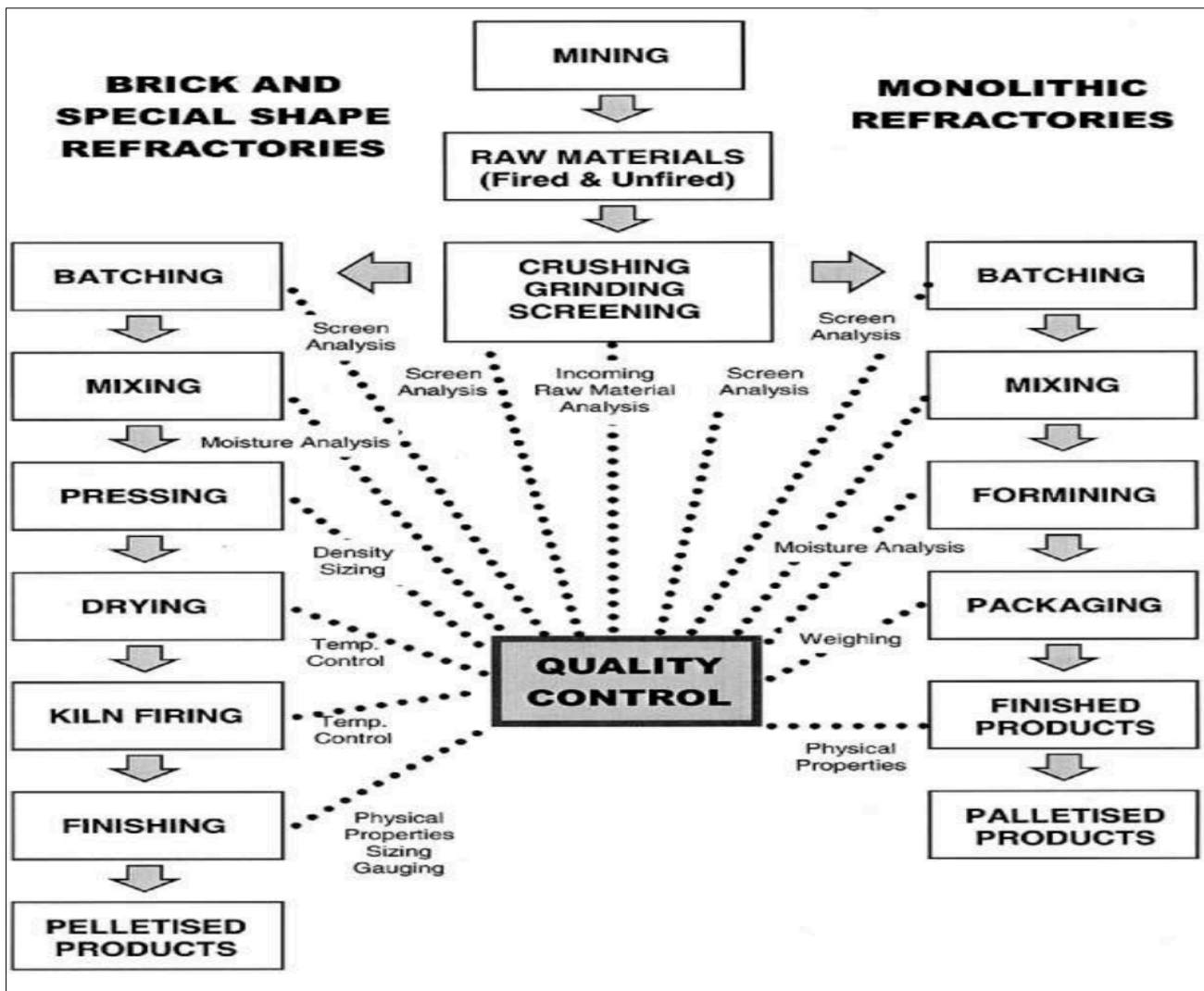
- **Pressing**

Pressed bricks have several advantages, especially high quality and homogeneity. For the production of pressable shapes, mechanical or most often hydraulic presses with pressures up to 200 N/mm² are used. The densification takes place in one direction only. The presses can produce one or more bricks at a time. The diagram shows the manufacturing process of refractory materials.

- **Drying**

The green products require proper drying and during the process, water that was initially absorbed during densification, is extracted. This is the most important stage of the manufacturing process. The drying has to be completed evenly throughout the brick. Without regulated drying, enormous tensions would develop within the brick owing to the generation of steam. An explosion can be fatal for the product and kiln as well.

Figure 23: Manufacturing process of refractories



Source: Hloben (2000)

The volatilisation and evaporation of the water cause drying shrinkage, which is typical for refractory products, especially the ones that contain alumina. Utmost caution is necessary as cracks would form that render the shape unserviceable.

- **Firing**

The dried green bricks are fired at temperatures between 1 250 and 1 800°C depending on the brick shape and type. In the early stage of this process, volatile components such as residual water or water of hydration are expelled, and part of the alkalis can vaporise. The brick densifies because of reactions in solid condition, recrystallisation, transitions or by establishing a liquid phase. This strengthening of the brick is called sintering. Further

shrinkage takes place, depending on the firing curve and on the chemical and physical composition of the mix.

Single chamber kilns, annular kilns, annular chamber kilns, hood-type kilns and most commonly tunnel kilns are used depending on size and quality of the shaped products and on the reactions of raw materials at certain temperatures. Depending on the product, the firing time, including preheating and cooling, can vary from three days to three weeks. Each step of the firing process is recorded and continuously checked. Although most refractory bricks are fired (ceramic bonded), they may also be chemically bonded and dried or chemically bonded and fired. Resin bonding with consequent tempering at 300 to 400°C is also increasingly used.

- **Quality, inspection and testing**

The implementation of ISO 9002 affects suppliers to the refractories industry; raw materials suppliers being the most important. A formal quality management system (QMS), based upon ISO 9000, covers all products manufactured and embraces all functions that affect product and service quality, including an independent test laboratory with state-of-the-art testing facilities.

Inspection and testing methods must be based on internationally accepted standards for the refractory industry and are continuously monitored to ensure that the company remains abreast with the latest international norms in the refractory industry. Every inspection takes place in strict accordance with the specified inspection manual.

2.6 REFRACTORY INDUSTRY IN SOUTH AFRICA

The South African refractory industry's foundation stems from way back in the early 20th century mainly due to the construction and establishment of the steel industry, various high temperature metallurgical extraction and smelting companies (Dickinson Group, 2020). Refractory manufacturing is part of the construction industry and has been active and in existence for more than 100 years, with Vereeniging Refractories, Vesuvius South Africa and Dickinson Group in excess of 100 years in operation.

In excess of 12 companies manufacture refractory materials in South Africa presently, with the majority specialising in refractory bricks, monolithic refractories, provision of niche installations services and technical support (Gauteng Region, 2021). Since the turn of the

21st century, the refractory industry has witnessed increased competition through an influx of imports, reduced market volumes due to economic distress and subsequent closure of certain steel plants, foundries and other smelting companies. This has significantly contributed to adverse operational challenges and the subsequent closure of some refractory manufacturing companies (du Plessis, 2015).

Vereeniging Refractories began operations in 1882; being the first company to manufacture refractory materials in South Africa, the company evolved through the 20th and the dawn of the 21st century becoming the largest refractory producer in the Southern Hemisphere with various operations and mines (Refractory & Metallurgical Solution, 2017). According to a news article by the Vaal Weekblad in August 2015, one of the key reasons behind the eventual closure of Vereeniging Refractories was the decline in business due to influx imports (du Plessis, 2015).

According to Vereeniging Refractories's (Verref) former chief executive officer Mr Tim Courtney, the market for refractory products in South Africa has been in decline for the past 10 years as a result of great import competition as well as a decline in the customer base (du Plessis, 2015). Vereeniging Refractories used to produce about 30 000 metric tons of refractory bricks per annum. Subsequent to the sharp downturn in the market, the company eventually closed its fired brick manufacturing plant in 2015 (du Plessis, 2015). The study by Mogoe, in 2014, examined the impact of foreign trade on economic growth in South Africa. The results showed that inflation rate, exports and exchange rate are positively related to GDP, while import has a negative influence on GDP (Mogoe, 2014). It is, however, worth further investigating the effects of imports per select manufacturing industries as different industries might experience variant dynamic changes because of imports on a microeconomic level.

Manufacturing activities are diminishing in Sub-Saharan Africa with the relocation of numerous industries to Asia – the same trend is widespread across the globe. The USA and European Union are also deindustrialising at higher levels of per capita GDP than Africa, with their economies tending to move into service offerings (Imbs, 2013). According to Imbs (2013), there is evident deindustrialisation of the South African economy, suggesting that trade, both local and global, contributes to the structural change from manufacturing to services. It is therefore imperative to investigate the effects of trade on deindustrialisation per sector in order to validate the hypothesis.

Another separate study by Mazo and Munapo in 2017 focused on the negative impacts of the presence of Chinese manufactured products in the global market and the effects on SA. One of the concluding recommendations was that the global market has other calcium carbide manufacturers from Europe that affect the local producers and further research should be conducted to include this variable (Mazo & Munapo, 2017). It is against the foregoing background and research gap that the author undertook the investigation to evaluate and assess the effects of imports of refractory bricks on the refractory manufacturing companies.

2.7 VALUE CHAIN DISRUPTIONS OF REFRACTORY MANUFACTURERS

The market for refractory products in South Africa has been in decline for the past 10 years as a result of high import competition as well as a decline in the customer base (du Plessis, 2015). According to Thompson *et al.* (2017:244), the large corporations expand internationally in order to gain access to new customers, achieve lower costs through economies of scale, gain purchasing power, access resources and capabilities located in international markets, and spread business risk across a wider market base. As the new market entrants gain new customers from a constant or shrinking market, the existing local manufacturers suffer due to a decrease in market share. The full-scale effects of imports result in value chain disruption of the local refractory manufacturing firms.

Figure 24: Typical value chain of refractory manufacturers



Source: SMstudy (2021)

2.7.1 Value chain

The value chain describes the full range of activities that are required to bring a product or service from conception, through the different phases of production (involving a combination of physical transformation and the input of various producer services), delivery to final consumers, and final disposal after use (Kaplinsky & Morris, 2001:4). An organisation's value chain identifies the primary activities that create customer value and the related supporting activities (Thompson *et al.*, 2017:127).

2.7.2 Marketing and sales

Marketing and sales are defined as the activities for selling and advertising products, for increasing sales by understanding the customers wants and needs (Cambridge Business English Dictionary, 2021). The marketing and sales activities relate to the salesforce efforts, advertising and promotion, market research and planning and distribution support (Thompson *et al.*, 2017:128).

The critical function of the marketing and sales department is to increase sales revenue of the business entity. It may be concluded that the first signs of a compromised market due to an increase in imports include decrease in sales revenue and market share. In order to ascertain the effects of imports on refractory brick manufacturers, the student investigated the direct effects of imports on the sales and marketing value chain.

2.7.3 Operations

Operations create value in the form of goods and services by transforming inputs into outputs. In manufacturing firms, the production activities result in the creation of tangible products (Hezer *et al.*, 2017:42). According to Thompson *et al.* (2017:128), operations activities encompass the conversion of inputs into finished products from production, assembly, packaging, equipment maintenance, facilities, operations, quality assurance and environmental protection.

Nothing happens until there is a sale ((Hezer *et al.*, 2017:42). Any operation's functions and activities are heavily dependent on the receipt of orders by the sales and marketing department. Any positive or negative effects on the sales of manufacturing or service company have a direct impact on the operations of the company. In order to ascertain the effects of imports on refractory brick manufacturers, the student investigated the direct effects of imports on the operations value chain.

2.7.4 Human resources

Human resource management relates to the activities that are associated with the recruitment, hiring, training, development and compensation for types of personnel, labour relations activities, and development of knowledge-based skills and core competences (Thompson *et al.*, 2017:128).

Any positive or negative effects on the sales and operations of a company have a direct impact on the human resources of the company. It may be concluded that an increase in sales might result in higher production to match the demand. In order to match the higher product demand, the company might increase production throughput and recruit additional labour. In order to ascertain the effects of imports on refractory brick manufacturers, the student investigated the direct effects of imports on the human resource management value chain.

2.8 CONCLUSION

The chapter describes reviewed literature pertaining to international trade, Africa's trade and South Africa's trade balance. Literature on the global refractory industry, global refractory suppliers, worldwide refractory brick trade, the refractory industry in South Africa, industry trends and the refractory end markets was introduced and described. The chapter lay the foundation of the existing body of knowledge and highlighted the refractory industry trade imbalances.

3 CHAPTER 3: EMPIRICAL STUDY SECTION

3.1 Introduction

Chapter 2 discussed and critiqued the various literature pertaining to globalisation, international trade, Africa's trade and South Africa's trade balance. The chapter also introduced the global refractory industry, global competition, the global refractory brick trade, the refractory industry in South Africa, its history, current state, industry trends and the refractory end markets. The chapter concluded with the description of the refractory industry value chain, consisting of marketing, operations, and human resources.

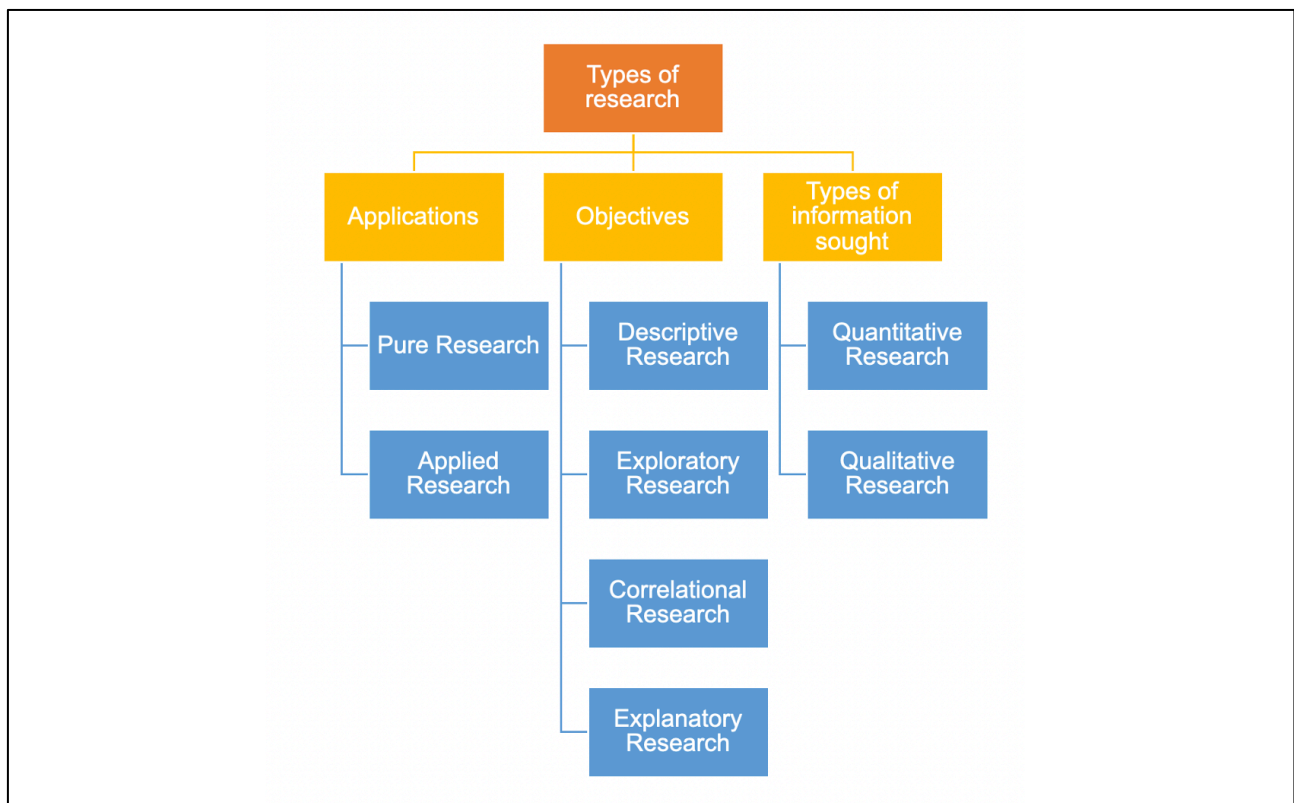
This chapter focuses on the empirical study, encompassing the:

- research design and approach
- population and sample
- measuring instrument
- data gathering
- statistical analysis
- interpretation of the results in-line with the outlined study objectives.

3.2 Research methods

According to Sukamolson (2007), research may be classified according to three main groups based on applications, objectives and the types of information sought. Research may also be categorised based on the time the data is collected for investigation. Henceforth, the main categorical groups are historical research, present research and futuristic research. The following figure 25 provides a depiction of types of research based on the applications, objectives and type of information sought.

Figure 25:Types of research



Source: Sukamolson (2007)

The research study undertook the quantitative approach, deductive and longitudinal design with a positivism epistemology. The deductive approach aims to explain the causal relationship between variables while involving the collection of quantitative data, application of controls for data validity, operationalisation of concepts and selection of sufficient samples to generalise conclusions. Epistemology relates to the constitution of acceptable knowledge in the study. Positivism pertains to working with observable social reality with end products being law-like generalisations similar to those of natural sciences (Saunders *et al.*, 2007:120-121). As part of applied research, the study aims to improve the understanding of the management problem and provide solutions, offer new knowledge and findings of practical value to the industry within the limited timescale (Saunders *et al.*, 2007:8).

3.2.1 Quantitative research

Quantitative research is defined as the numerical representation of observations for purposes of describing and explaining the phenomena that the observations reflect (Sukamolson, 2007). According to Goertzen (2017), quantitative research methods deal with

collecting and analysing data that is structured and presented numerically. The findings of quantitative research unearth and highlight behaviour and trends across datasets, but do not provide the motivation behind the observed trends and behaviours.

According to Goertzen (2017), the six key characteristics of quantitative research are:

- Data measurement and quantification.
- It assesses information numerically
- Aims to be objective.
- The findings can be evaluated using statistical analysis.
- The research represents complex problems through variables.
- The results can be summarised, compared, or generalised.

The findings can provide evidence or answers to demonstrate to what extent services are used and accessed, to back up claims about use and impact, to provide evidence for a particular phenomenon and whether adjustments should be made. In addition, it assesses whether informed decisions are or are not worth pursuing, demonstrates evidence for trends and proves or discounts what is known anecdotally. Furthermore, it provides a method to make information accessible to audiences and provide evidence of success and highlight areas where unmet information needs exist (Goertzen, 2017).

The main advantages of using quantitative research entail the following:

- The findings can be generalised to a specific population.
- Datasets are large, and findings are representative of a population.
- The research framework and methods can be shared and replicated.
- Standardised approaches permit the study to be replicated over time.

The main limitations of quantitative research approach are:

- Data does not provide evidence for the way the population thinks, feels, or acts in a particular manner.
- Specific demographic groups, particularly vulnerable or disadvantaged groups, may be difficult to reach.
- Studies can be time consuming and require data collection over long periods of time.

For purposes of this research study, the quantitative research approach was utilised; this process included data collection, data measurement and evaluation of the findings through statistical analysis.

3.2.2 Positivism

The positivism philosophy is based on the trustworthiness view of factual knowledge gained through observation. Positivism studies depend on quantifiable observations that result in data collection, interpretation and statistical analysis (BRM, 2021). This research study follows the positivism philosophy.

3.2.3 Deductive

Deductive research pertains to the development of a hypothesis based on existing theory and designing a research approach to test the hypothesis. The deductive design might test or indicate the relationship, while deducing conclusions from premises and propositions (BRM, 2021). This research study follows the deductive design, approach and reasoning.

3.2.4 Research design

Research design focuses on transforming the research question and objectives into a research project through utilisation and consideration of the research strategies, approaches and time horizons (Saunders *et al.*, 2007:153). The quantitative research approach enables convenient gathering of vast amount of data within the limited timeframe and permits the researcher to obtain a sample and generalise the findings of the population (Bryman *et al.*, 2014:31). The study involved simultaneously collection of data through questionnaire and secondary data in order to infer theoretical ideas on the causality of variables (Bryman *et al.*, 2014:34).

The study took a longitudinal design approach that is primarily associated with mapping changes over a specific period and contextualising the processes influencing change. According to Bryman *et al.* (2014:109), a longitudinal research design provides a platform for analysing occurrences vertically and horizontally in a bid to detect the correlations of the variables. The researcher obtained high quality data as historical records on refractory imports from credible official government statistical databases. The historical operations records were obtained from refractory manufacturers directly. The ease of access and convenience of secondary data reduced the time and cost constraints that are normally associated with longitudinal design approaches.

A study of the local refractory brick manufacturing companies in Gauteng was performed to fully assess the influence of brick imports. This was achieved using the quantitative research approach.

3.3 Sample and population

The study population refers to the universe of all units from which a sample is chosen or selected (Bryman *et al.*, 2014:170). The study population was defined as all the employees working for the two prominent refractory brick manufacturing companies in South Africa. A sample is defined as a portion of the population that is selected for investigation (Bryman, *et al.*, 2014:170).

In business research, probability sampling may not be appropriate to answer the research question and meet the objectives. Non-probability sampling offers an array of alternative techniques to select samples based on subjective judgement (Saunders *et al.*, 2007:226). Purposive sampling is a non-probability and strategic sampling technique that ensures that sample cases are practically applicable and relevant to the research questions (Bryman *et al.*, 2014:186). Purposive sampling techniques include extreme case, heterogeneous, homogenous and typical case sampling. In this research study, purposive sampling was selected as the sampling technique.

The sample for the research study was defined as decision-makers and managers working for refractory brick manufacturing companies in South Africa during the time of the investigation. The sample population possessed relevant experience in refractory manufacturing functions and value chains such as sales and marketing, human resources, research and development, operations, finance, and technical. The select sample possesses prerequisite knowledge in the field of study based on their respective occupations, and therefore they responded relevantly and objectively to the research. The targeted sample size comprised 50 managers and decision-makers.

Table 3: Population and sample

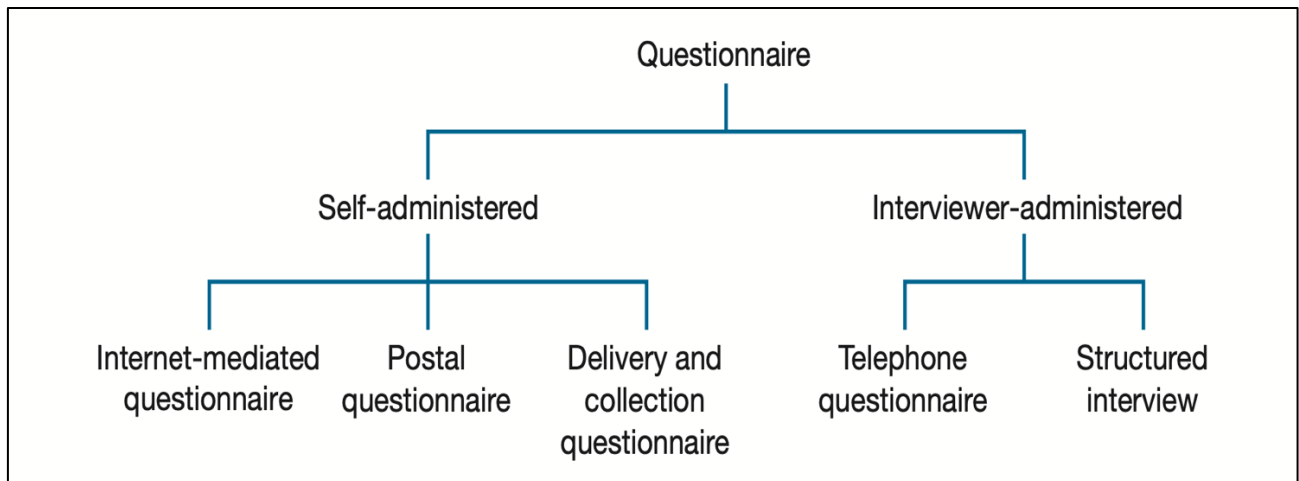
	Managers	Subordinates	Total
Population	42	597	All employees
Sample	30	20	50

3.4 Gathering of data

3.4.1 Survey instrument

A questionnaire was designed, developed and used as an instrument for data collection from the target sample. The instrument was strategically developed to meet the research objectives and answer the research questions.

Figure 26: Types of questionnaires



Source: Saunders *et al.* (2007)

The researcher selected the self-administered questionnaire for the purpose of this study. The self-administered questionnaires were mediated through the internet and by delivery and collection. The internet-mediated questionnaires were distributed by email in Microsoft Word format. Respondents returned the questionnaires through email and by delivery to the investigator. The delivery and collection mediated questionnaires were issued to the various functional departments and collected upon completion by the investigator.

According to Manda (2017), the advantages of using questionnaires may be illustrated as follows:

- Highly practical,
- Large amounts of information can be collected cost effectively from many people in a short period of time
- This can be carried out by the researcher on multiple individuals with little or no effect to the reliability
- The questionnaire results can be swiftly and easily quantified through the software packages

- Information can be analysed scientifically and objectively
- The collected data can be used to create new theories and test existing hypotheses

It may be argued that questionnaires have disadvantages such as:

- Inadequate to understand forms of information such as emotions, feelings, truthfulness and thoughtfulness.
- It is an artificial creation by the investigator and may possess limited information without explanation
- People read and interpret questions differently, and therefore there is an element of subjectivity

Irrespective of the shortfall, questionnaires are widely utilised in research. In this research study, the data collection instrument was structured in the following manner:

Section A

- Demographics

Section B

- Perceived effects on market share and sales

Section C

- The perceived effects on manufacturing operations and capacity

Section D

- Perceived effects on manpower

3.4.2 Demographics

Section A comprised the following demographics:

- Gender
- Years of experience in refractory industry
- Department
- Years in current position
- Highest level of education

3.4.3 Operations constructs

The measured constructs comprised three sections that depicted the organisational value chains of the refractory manufacturing companies. Several questions were used to measure each construct.

3.4.4 Sales and market share constructs

Section B was divided into two critical constructs, namely market share and sales.

The construct objective was to measure the perceived effects on market share and sales.

The construct was measured using the following statements: B1, B2, B3, B4, B5, B6, B7, B8, B9 and B10

3.4.5 Production output and capacity utilisation constructs

Section C was structured based on the two critical constructs of production output and capacity utilisation. The construct objective was to measure the perceived effects on production output and capacity utilisation.

- Production output: Statements C1, C2, C3 and C4
- Capacity utilisation: Statements C5, C6, C7, C8 and C9

3.4.6 Manpower and employment construct

Section D comprised manpower levels or employment levels

The construct objective was to measure the perceived effects on employment levels in the refractory industry.

- Manpower: Statements D1, D2, D3, D4 and D5

3.5 SECONDARY DATA SOURCES

It can be time consuming and expensive to use some of the data gathering techniques. Secondary data analysis provides an alternative that is a less time consuming and less expensive mean of collecting and analysing readily available data. Secondary data and documentary analysis gather quantitative data about the business and management, which has already been collected by government, social scientists and professionals alike. The secondary data includes official statistics collected by government departments in their

course of work or during any statistical work. Secondary data is essential in situations where data cannot be collected using primary data collection (Miller & Brewer 2003).

According to Bryman *et al.* (2014:267), secondary analysis occurs when a researcher analyses either quantitative or qualitative datasets that were collected by another researcher. Secondary analysis offers multiple benefits such as cost and time, readily availability of high quality data, opportunity for longitudinal analysis, subgroup and subset analysis, opportunity for cross-cultural analysis, more time for data analysis and the possibility of new interpretations from re-analysis. The researcher utilised the secondary data from the Department of Trade Industry and Competition.

The Department of Trade Industry and Competition (the dtic) was established after the merger of the Department of Trade and Industry and the Economic Development Department. The DTIC's mandate is encompassed in its vision and mission. The vision of the DTIC is defined as a dynamic industrial, globally competitive South African economy, characterised by meaningful economic transformation, inclusive of growth and development, decent employment and equity, built on the full potential of all citizens (DTIC,2021).

The DTIC's mission comprise the following:

- Promote structural transformation towards a dynamic industrial and globally competitive economy
- Provide a predictable, competitive, equitable and socially responsible environment, conducive to investment, trade and enterprise development
- Broaden participation in the economy to strengthen economic development
- Continually improve the skills and capabilities of the dtic to effectively deliver on its mandate and respond to the needs of South Africa's economic citizens
- Co-ordinate the contributions of government departments, state entities and civil society to effect economic development
- Improve alignment between economic policies, plans of the state, its agencies, government's political and economic objectives and mandate

The researcher managed to obtain the data on imports of refractory materials from the Department of Trade Industry and Competition's website and datasheets. The dataset was filtered and selected from the website using a specific harmonised system (HS code) for refractory materials. The harmonised system is defined as an international nomenclature for

the classification of products. It allows participating countries to categorise traded goods on a common basis for customs purposes.

The harmonised system consists of approximately 5 300 product descriptions that appear as headings and subheadings, arranged in 99 chapters and grouped in 21 sections. The system was first introduced in 1988 and has since been adopted worldwide; it has also undergone several changes in classification of products (UNSD, 2021). The HS code used was HS:6902 for refractory bricks, blocks, tiles and similar refractory ceramic constructional goods, other than those of siliceous fossil meals. The collected dataset ranged from 2000 up to the latest 2018 records.

3.6 CREDIBILITY OF RESEARCH FINDINGS

Reliability, replication and validity of the data are of critical importance in quantitative research. The three critical components ensure rigour and credibility of the research findings.

3.7 RELIABILITY

Reliability refers to the extent to which your data collection techniques or analysis procedures will yield consistent findings. This can be assessed by posing the following three questions (Saunders *et al.*, 2007:149):

- Will the measures yield the same results on other occasions?
- Will similar observations be reached by other observers?
- Is there transparency in how sense was made from the raw data?

The threats to reliability include participant error, participant bias, observer error and observer bias. In this research study, significant steps and action were taken in order to eliminate and minimise the threats to reliability.

Reliability is concerned with robustness of the questionnaire in terms of consistent with the findings. According to Mitchell (cited by Saunders *et al.*, 2007:367), the three common approaches of assessing reliability, in addition to comparing the data collected with other data from a variety of sources, include test re-test, internal consistency and alternative form. Test re-test is obtained by correlating data collected with those from the same questionnaire;

henceforth, the questionnaire is administered twice. The disadvantage of the test re-test method is the difficulty of persuading respondents to answer the same questionnaire twice.

The second method of internal consistency implies correlating the responses to each question in the questionnaire with those to their questions in the questionnaire. It measures the consistency of responses across all questions or subgroups of the questions from the questionnaire. A variety of methods exists for calculating internal consistency; however, the most frequently used is the Cronbach's alpha. The alternative form compares responses to alternative forms of the same question or group of questions. Checked questions are employed in this regard; however, it is difficult to ensure equivalence of the questions. Furthermore, there is a risk of respondents suffering from fatigue due to the long check questions.

In conclusion, for purposes of this research study, the reliability was measured using the internal consistency method and the Cronbach's alpha test was used. The Cronbach alpha tests were conducted using SPSS computer software.

3.8 REPLICATION

Replication implies the ability to replicate and reproduce the findings of other researchers by establishing whether the original results are applicable and valid within a different context (Bryman *et al.*, 2014:24). This research study employed a structured methodology in order to facilitate replication.

3.9 VALIDITY

Validity aims to establish the integrity of results generated from the research (Bryman *et al.*, 2014:24). Validity is concerned with whether the findings are really about what they appear to be about. For example, checking if the relationship between two variables is a causal relationship (Saunders *et al.*, 2007:150). The threats to validity range from history, testing, instrumentation, mortality, maturation and ambiguity about causal direction.

Validity categories include measurement validity, internal validity, external validity and ecological validity. The measurement validity is strongly aligned to reliability of the measurement instrument and its stability. Internal validity questions whether the conclusion

of a causal relationship between two or more variables holds water. The triangulation of multiple sources of data will be used to corroborate the research question. The quantitative research approach presents the investigator with an opportunity to generalise the findings and ensure external validity. The author provided representative samples in order to ensure external validity of the results. The research topic dealt with the importation of goods into the local market, which is a common phenomenon in the modern-day 21st century era, and therefore concludes the ecological validity of the investigation (Bryman *et al.*, 2014:24).

3.10 METHOD OF DATA ANALYSIS

To accomplish the purpose of the research study, statistical analysis methods and approaches were utilised using the Statistical Package for Social Sciences (SPSS) software. The Statistical Consulting Services at North-West University extensively assisted with the statistical analysis and adopted questionnaire structuring.

Descriptive analyses were used for ascertaining the distribution of variables such as measures of central tendency (mode, mean, mode) and measures of dispersion, such as the range, variance and standard deviation (Bryman *et al.*, 2014:319). The mode represents the value that occurs most frequently, while the median represents the middle value and the mean includes all the data values. The range denotes the difference between the highest and lowest values, while the variance indicates the extent to which the data values differ from the mean between variables (Saunders *et al.*, 2007:436).

SPSS was employed for analysing the responses of the participants in order to assess the relationship between the import quantities and operations value chain constructs. Statistical inference refers to the process of drawing conclusions about populations or scientific truths from data. The modes of performing inference include statistical modelling, data oriented strategies and explicit use of designs and randomisation in analyses (Caffo, 2021). In this research investigation, statistical inference was used based on the statistical modelling mode. In conclusion, data was analysed to investigate the strength and direction of the relationship between import quantities of refractory bricks and performance indicators of the local refractory brick manufacturers in Gauteng.

3.11 CONCLUSION

The main objective of Chapter 3 was to furnish the research methods and techniques to answer the research questions and meet the objectives of the study. The chapter also clarified the study population, sample and sampling strategy, while establishing the ethical considerations, the reliability and validity, the data collection process and capturing, as well as statistical analysis. The quantitative data was collected, and descriptive statistics and inferential statistical analysis were employed as data analysis methods. Chapter 4 provides the findings, discussion and interpretation of the research study results.

4 CHAPTER 4: RESULTS, DISCUSSION AND INTERPRETATION OF FINDINGS

4.1 Introduction

Chapter 1 introduced the diverse sections of the research including the research topic, underpinning background, problem statement and core research question, the research objectives, as well as the importance and benefits of the proposed study.

Chapter 2 discussed and critiqued the various literature pertaining to globalisation, international trade, Africa's trade and South Africa's trade balance. The chapter also introduced the global refractory industry, global competition, the refractory industry in South Africa, its history, current state, industry trends and the refractory end markets. The chapter concluded with a narrative of the refractory industry value chains, consisting of marketing, operations and human resources.

Chapter 3 outlined the methodology utilised during the research study. The research approaches and data collection methods were presented. The study population, sample and sampling strategy were clearly elaborated. The chapter also included the ethical considerations, the reliability and validity, the data collection process and capturing, as well as statistical analysis.

This chapter presents the results, discussions and interpretation of findings of the secondary data and empirical study. The first section provides the analysed demographic information including frequencies of the respondents. The Cronbach's alpha coefficient was calculated and presented. The second section furnishes an analysis that seeks to fulfil the primary research objective of identifying and evaluating the extent to which the local brick manufacturers in South Africa have been impacted by the presence of refractory brick imports in the local market. The last section offers an analysis and discussion on answering the secondary research questions and fulfilling the secondary research objectives. The results of each response category and construct were discussed and interpreted. Tables, pie charts, bar charts and histograms were employed to present and interpret the data analysis. The research was subjected to a sample of 50 individuals with 37 successful respondents, highlighting a 74% response rate.

4.2 Secondary data results

The researcher managed to obtain the data on imports of refractory materials from the Department of Trade Industry and Competition's website. The following data was translated directly, and it covers the period from 2000 up to 2019. The data was mapped in graphical format in order to show the various changes over the duration. Furthermore, the data was also adjusted for inflation based on the consumer price index (CPI) from 2000 up to 2019.

4.2.1 Nominal and real value of imports

The nominal results illustrate the gradual increase of refractory bricks imports in South Africa from the 2000 up to 2019, with a drop in 2003 and major peaks in 2008 and 2018. Table 4 shows the inflation-adjusted real import values based on the average CPI index using 2019 as a baseline.

Table 4: Imports values of refractory bricks

Year	Nominal refractory brick imports HS6902	Inflation adjusted brick imports (ZAR)
2000	R 401 497 588	R 1 131 860 035
2001	R 432 155 932	R 1 154 473 704
2002	R 509 596 313	R 1 245 679 876
2003	R 58 781 908	R 135 986 187
2004	R 455 329 637	R 1 038 373 684
2005	R 558 285 927	R 1 230 642 063
2006	R 681 437 258	R 1 437 166 548
2007	R 716 861 477	R 1 411 085 223
2008	R 1 003 806 613	R 1 770 866 383
2009	R 816 326 238	R 1 350 911 562
2010	R 850 943 484	R 1 350 436 477
2011	R 943 667 915	R 1 426 947 979
2012	R 948 927 875	R 1 358 031 984
2013	R 922 740 392	R 1 248 871 797
2014	R 936 750 893	R 1 194 357 389
2015	R 994 930 204	R 1 213 382 271
2016	R 1 001 048 708	R 1 148 442 383
2017	R 1 029 413 968	R 1 121 361 623
2018	R 1 960 726 896	R 2 040 756 565
2019	R 1 209 078 862	R 1 209 078 862

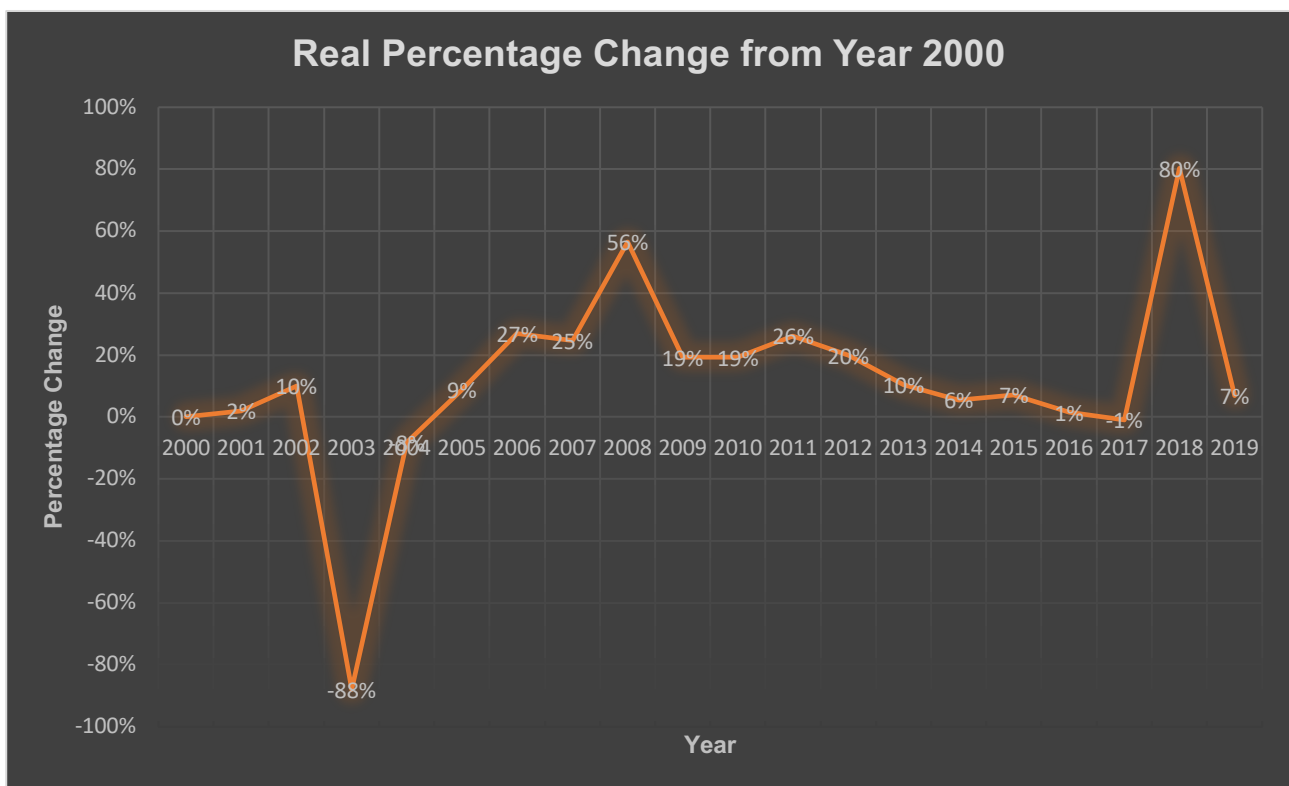
Source: DTIC (2021)

Major drops are also noted in 2003 and major peaks in 2004, 2008 and 2018. The gradual increasing trend is also noted.

4.2.2 Real change in imports

The real change in imports may be depicted by the following graph. The graph illustrates the percentage change in of each discrete year's value in comparison to the benchmark year, 2000. Based on this comparison, a major decrease in imports is only noted in 2003 with a minus 88% change. Most of the data points (79%) show significant import volume increases with peaks of 27% in 2006, 56% in 2008, and 80% in 2018.

Figure 27: Real change in percentage terms from year 2000



Source: Author (2021)

It may be concluded that a notable trend of increase in volume and value of imported refractory bricks exists. This remarkable increase has a direct impact on the South African market conditions and operations of the local refractory brick manufacturing firms. It remains to be noted if the growth had an impact on the value chains of the refractory manufacturing firms. The following sections attempt to answer the question comprehensively.

4.3 Primary data results

The proceeding section presents the results, interpretation and a discussion of the primary data analysis. The section answers the primary and secondary research questions. This section provides the reliability statistics, demographic samples' results, and responses to the research objectives.

4.4 Reliability statistics

The Cronbach alpha coefficients were used to assess the reliability of the constructs that measured the study and the data. Reliability measures if a questionnaire and its underlying factors are consistently reflecting what it is measuring (Saunders *et al.*, 2007). In order to assess reliability, negatively phrased statements were embedded intentionally within the data collection instrument and these were reverse scored. The below table shows the reliability statistics for the study.

Table 5: Reliability of the study

Reliability statistics		
Cronbach's alpha	Cronbach's alpha based on standardised items	N of items
0,637	0,670	10

Source: Author (2021)

The reported Cronbach alpha values are all above the guideline value of at least 0.5 (in the early stages of research), which indicates that the resulting factors are reliable. The means ranged between 4.92 (SD = 0,99) and 5.78 (SD = 1.03), indicating that respondents on average slightly agree to moderately agree with the statements within these factors.

4.5 Demographics of participants

4.5.1 Response rate

The table below shows the quantity of questionnaires that were issued and the corresponding responses that were received from the participants.

Table 6: Response rate

Issued questionnaires	Responses	Response rate
50	37	70%

Source: Author (2021)

4.5.2 Overall demographic

The demographic profile of the participants was diverse based on gender, experience in the refractory industry, functional department, and level of education. The following table provides the demographics that were discussed in the following section.

Table 7: Demographics

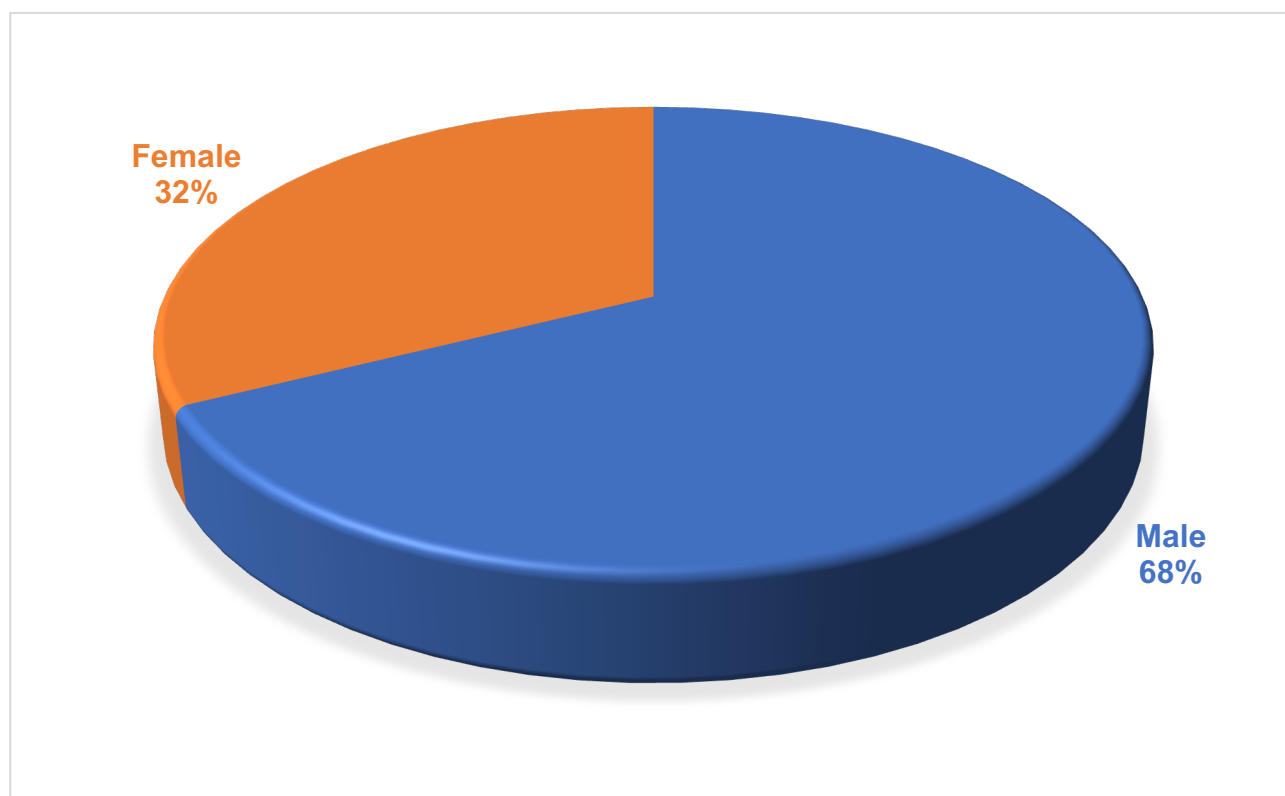
Item	Demographic profile
1	Gender
2	Experience in the refractory industry
3	Functional department
4	Years in current position
5	Highest level of education

Source: Author (2021)

4.5.3 Distribution according to gender

The figure below shows the distribution of the respondents according to gender.

Figure 28: Distribution according to gender



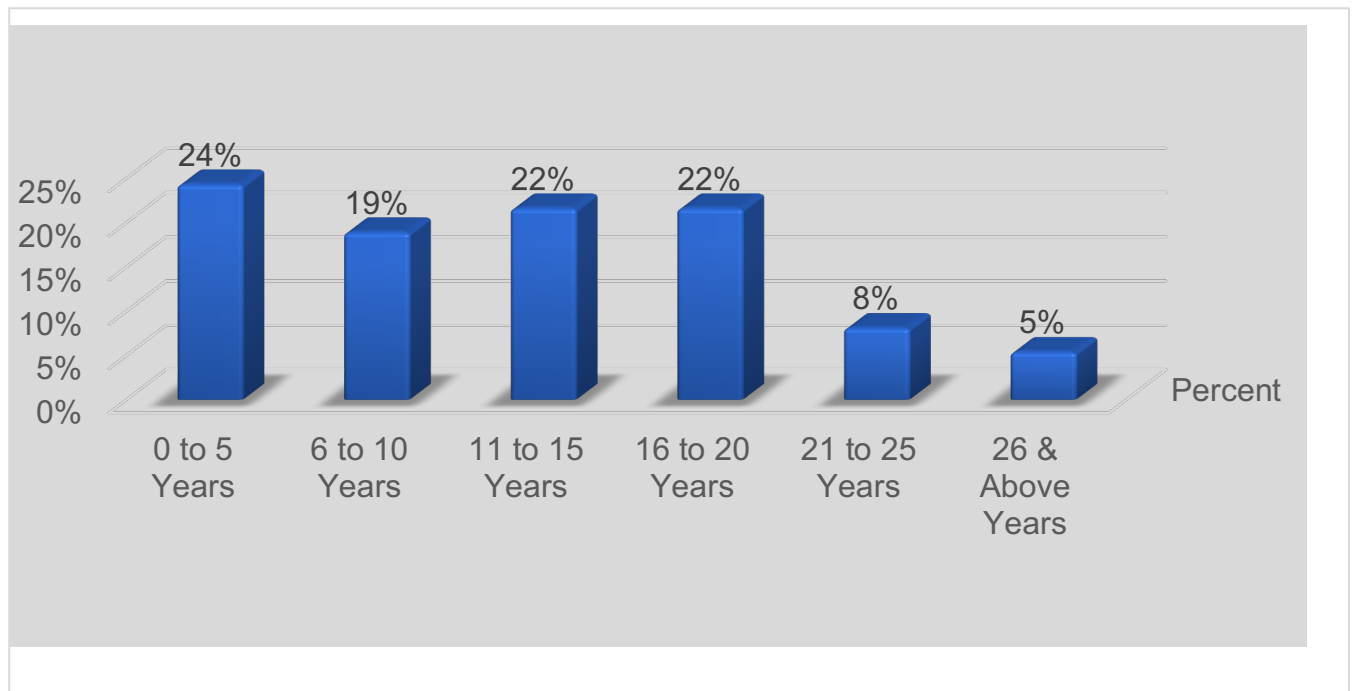
Source: Author (2021)

The largest proportion of the respondents were males ($n=25$; 67.6%) and the remainder were females ($n=12$; 32.4%). According to Statista (2020), the population of females in South Africa is 30.09 million representing about 50.73% of the populace. Although males are fewer than female in South Africa, the sample illustrates a gender imbalance in the refractory industry. This proves that the refractory industry is male dominated.

4.5.4 Participation based on experience

The level of experience in the refractory industry played a crucial role in the ability of respondents to answer the questions in the data collection instrument. The respondents possessed a wide range of experience, from zero to five years up to 26 years and more. The following bar chart provides a narrative of the sample's level of experience.

Figure 29: Duration of refractory experience of respondents



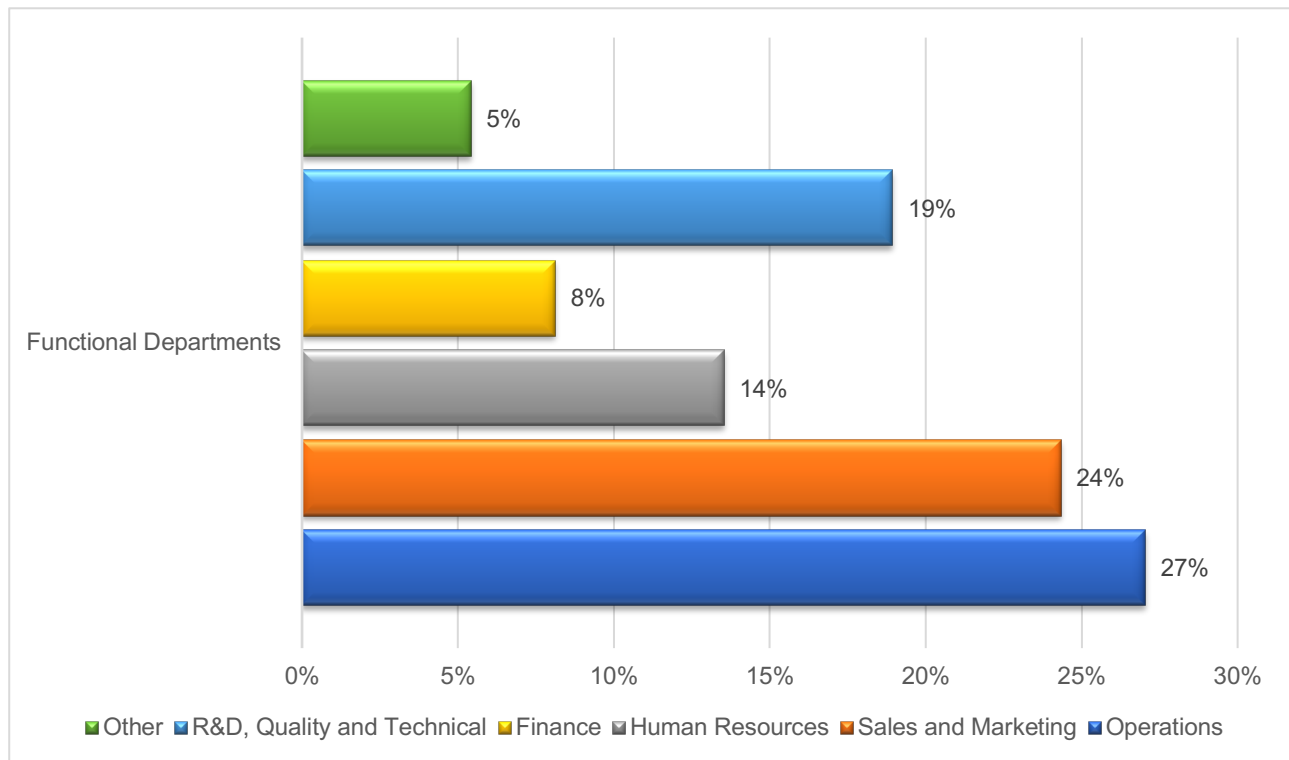
Source: Author (2021)

The respondents were almost equally distributed with regard to years of experience in the refractory industry's first four categories, with zero to five years' experience (n=9; 24.3%), six to 10 years' experience (n=7; 18.9%), 11 to 15 years; experiences (n=8; 21.6%) and 16 to 20 years' experience (n=8; 21.6%), respectively. A very small proportion of the respondents indicated 21 to 25 years' experience (n=3; 8.1%) and 26 or more years' experience (n=2; 5.4%). The overall composition of participation provided a very well-balanced response as the sample was based on the entire population distribution and divide of experience.

4.5.5 Distribution according to functional department

The functional departments played a significant role in this study. The assumption is that some responses towards the effects of imports of specific functional departments might vary depending on the functional department of belonging. The results and distribution according to functional department are presented in the following chart.

Figure 30: Participation according to functional department



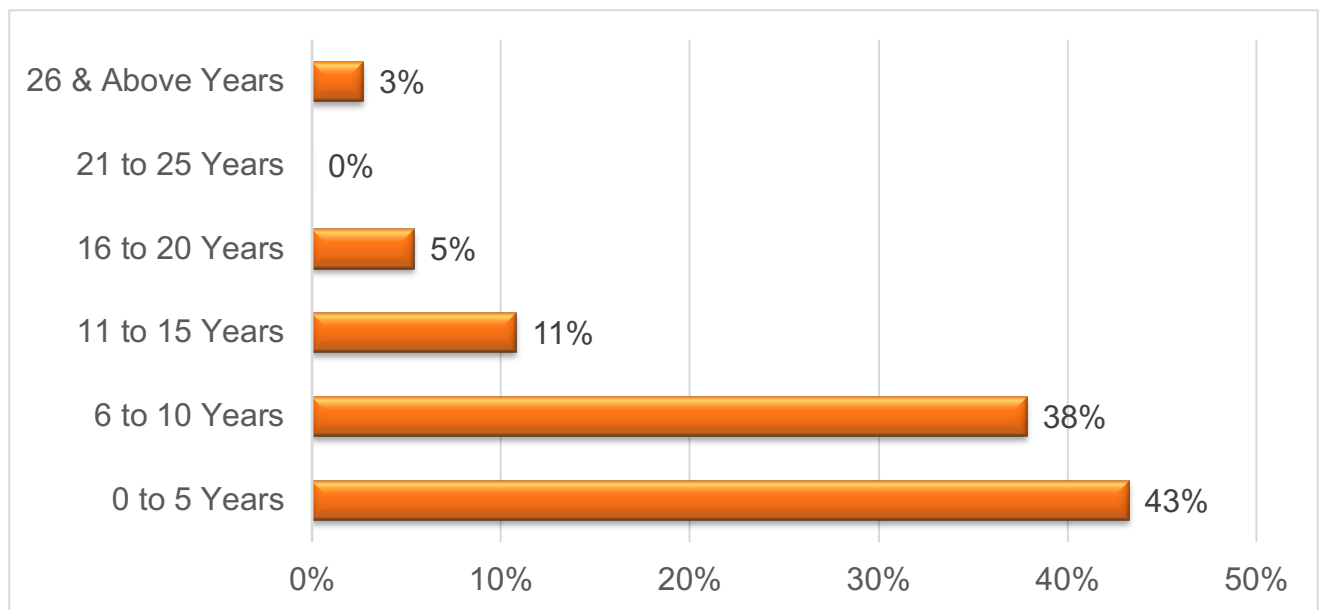
Source: Author (2021)

The findings show that the highest participating functional department was operations with 27%, followed by sales and marketing with 24%. Research and development, quality and technical were third with 19%, with human resources following at 14% and finance with the least participation of 8%. About 5% of the respondents did not specify a specific functional department from the list provided and therefore selected the option of *other*.

4.5.6 Duration in current occupation

The duration of respondents in current occupation was analysed and the results are presented in the following bar charts. The findings reveal that about 43% of participants are in the zero to five years range within the current occupation, preceded by the six-to-10-year range, comprising 38% of the participants. The first two ranges from zero-to-10 year presented about 81% of the participants. The 11-to-26-year range comprised 19% participation. Generally, this indicates that there might be high employee turnover and the refractory job market might be shrinking.

Figure 31: Distribution by experience in current occupation

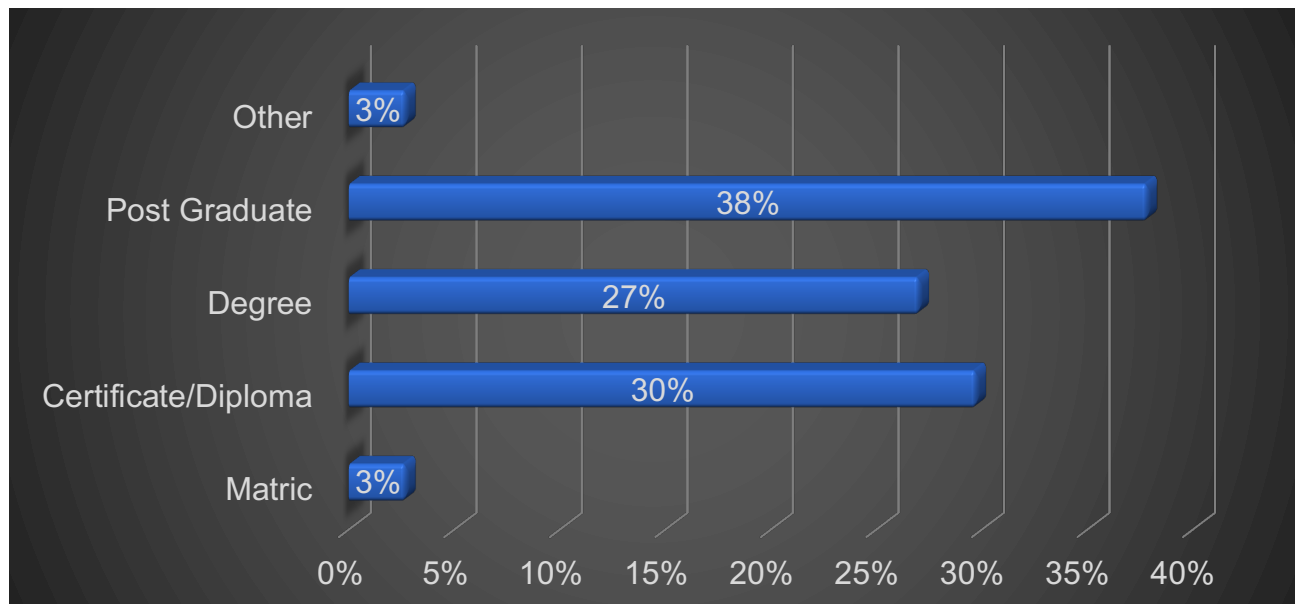


Source: Author (2021)

4.5.7 Participation based on highest level of education

The highest level of education of the respondents was a critical factor in evaluating the proper aptitude and relevance in responding to the data collection instrument.

Figure 32: Distribution according to highest level of education



Source: Author (2021)

As presented in the figure above, most respondents possessed a post-graduate qualification (38%), followed by those holding a certificate or diploma at 30%. The Bachelor's degree holders comprised 27%, with the matric holders recording the lowest at 3%. In summary, the population sample illustrates a high level of education with 65% having a university-level education of bachelors and above.

4.6 Response comparisons by demographic profile

The independent t-test determines whether there is a significant difference between the means in two unrelated groups. The Mann-Whitney test is non-parametric version that tests if the mean ranks of two unrelated groups are significantly different. P-values are reported for completeness sake, but will not be interpreted since a convenience sample instead of a random sample was used; based on the reported effect sizes there are mostly practically insignificant differences in the means and mean ranks of the different genders. Except for 'sales and marketing' where a practically significant (effect size = 0,77) / visible effect size = 0,35) difference has been reported. The males (mean = 5.49; SD = 0.76) on average slightly to moderately agreed with the statements within this factor, and the females (mean = 4,91; SD = 0,63) on average slightly agreed. This reflects that males strongly feel that the effect of refractory imports on sales and market share is much more significant compared to how females perceive it.

4.7 Descriptive statistics for value chains

Descriptive statistics for the organisational value chains are presented in the following section. The descriptive statistics include the number of cases, mean average and standard deviation of the variables.

4.7.1 Summary of constructs

The mean score for the constructs ranged between 4.92 and 5.78. The scores indicate that respondents on average slightly agreed to moderately agreed with the statements within the constructs. Table 8 depicts the comparison of the mean scores and the Cronbach's alpha for the different constructs considered in the investigation.

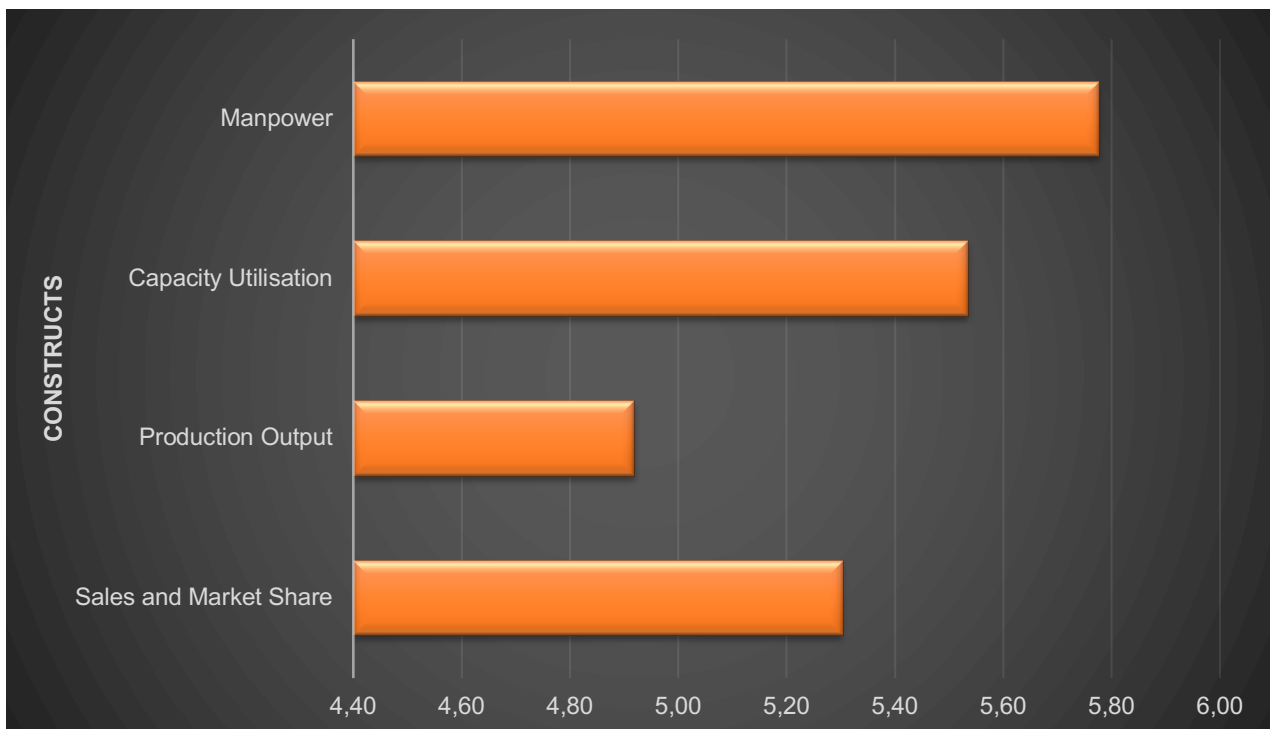
Table 8: Summary of the four constructs on a seven-point scale

Factor	Cronbach's alpha	Mean	Likert scale minimum possible	Likert scale maximum possible
Sales and market share	0,65	5,30	1	7
Production output	0,66	4,92	1	7
Capacity utilisation	0,62	5,54	1	7
Manpower	0,82	5,78	1	7

Source: Author (2021)

The constructs' mean scores were plotted in graphical format below:

Figure 33: Mean scores for the constructs



Source: Author (2021)

4.7.2 Mean scores for chain constructs

The following section provides the detailed mean scores for the constructs for the various operations' value chains under consideration in the research study. The table will include the following:

- Sales and market share
- Production output
- Capacity utilisation
- Manpower

Table 9 below shows the mean score for the sales and market share construct.

Table 9: Mean scores for the sales and market share construct

No	Statement	N	Mean	Std. deviation
B1	Locally made brick sales have been on a general decrease over the past 15 to 20 years.	37	5,92	0,76
B2	Imported bricks have become cheaper in recent years.	36	5,58	
B3	Brick importers have gained market share in recent years.	37	6,03	
B4_R	The competition from imported bricks has not reduced the sales of locally made bricks.	37	5,22	
B5_R	The market share of local brick manufacturers has increased in South Africa over the past 15 to 20 years.	37	5,49	
B6_R	Local brick sales will meet futuristic outlooks (set forecast, targets and goals) despite imports.	37	5,03	
B7	In South Africa, a number of customers now prefer to import similar bricks to what they used to buy locally.	37	5,70	
B8	Lower prices always represent lower quality on imported products.	37	3,57	

No	Statement	N	Mean	
B9	Some customers do not want to pay high price for high quality local products.	37	5,49	
B10	In South Africa, few customers of refractory bricks are closing down due to economic conditions.	37	4,16	
Sales and market share			5,30	0,76

Source: Author (2021)

The mean score in Table 9 is 5.30, indicating that the respondents slightly to moderately agree with the statement regarding the negative effects of imports. Table 10 below shows a mean score for the production output construct of 4.92. This indicates that the respondents slightly agreed with the statements.

Table 10: Mean score for the production output construct

No	Statement	N	Mean	Std. deviation
C1	The local brick plant production output has been on a general decrease over the past 15 to 20 years.	37	5,57	0,99
C2_R	The demand for some specific brick types by local customers has been on a general increase.	37	4,73	
C3	The brick plant has made some operational changes in the past to keep up with foreign competition and brick import traders.	37	4,84	
C4	The demand for some bricks shapes by local customers has been on a general decrease.	37	4,54	
Production Output			4,92	0,99

Source: Author (2021)

Table 11 below shows the mean score for the production output construct of 5.54, denoting that the respondents moderately agreed with the statements.

Table 11: Mean score for the capacity utilisation construct

No	Statement	N	Mean	Std. deviation
C5_R	The capacity utilisation of the brick plant has been on general increase in recent years.	37	5,62	0,92
C6	The local brick making plants sometimes operate intermittently due to low demand.	37	5,62	
C7	Some brick making equipment has been idle in recent years.	37	5,24	
C8	More variety of bricks was produced locally ten years back.	37	5,51	
C9_R	Local brick production volumes have increased in recent years.	37	5,68	
Capacity utilisation			5.54	0,92

Source: Author (2021)

Table 12 below shows the mean score for the manpower and job market construct of 5.78, indicating that the respondents moderately agreed with the negative effects of refractory brick imports on the local refractory job market.

Table 12: Manpower and job market mean scores

No	Statement	N	Mean	Std. deviation
D1	The local brick making industry job market has been shrinking over the years	36	6,06	1,03
D2	The number of people employed in the brick making industry is decreasing due to low brick demand.	36	5,61	
D3	Some jobs in the local brick making plants are under threat	37	5,73	
D4_R	The brick making industry did not need to make changes to the shifts to adjust for the low demand	37	6,19	
D5	The brick plant has not replaced some vacant positions when employees retire or resign	37	5,38	
Manpower / Job Market			5.78	1,03

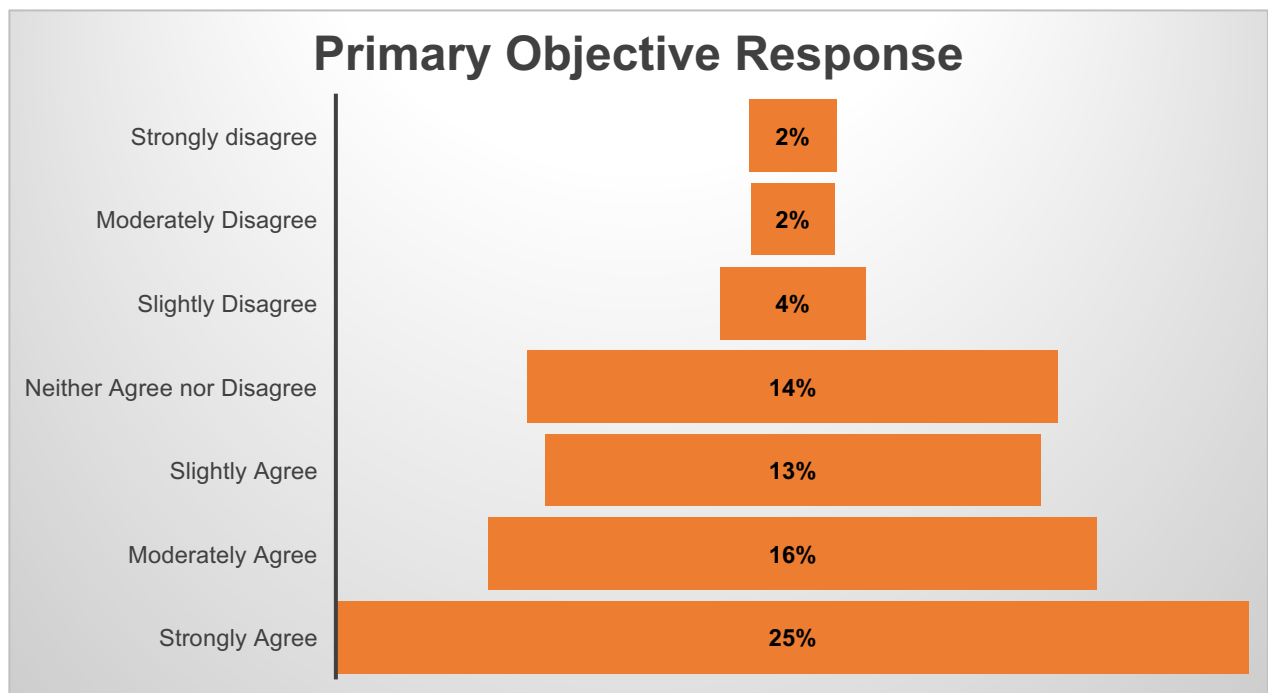
Source: Author (2021)

4.8 Responses to primary research objectives

The primary objective sought to identify and evaluate the extent to which the local brick manufacturers in South Africa have been affected by the presence of refractory brick imports in the local market. It may be noted that the overall mean score of 5.39 denotes that respondents slightly agreed (77%) that local brick manufacturers have been negatively impacted by the emergence and persistent presence of imports on the local market.

The findings in the following graph show that about 28% strongly agreed, 16% moderately agreed and 13% slightly agreed. In summary, about 54% agreed that imports have a negative effect on the local producers, while 8% of the respondents disagreed. The difference between the agreeing respondents and those disagreeing is very significant at 46%, as shown in Figure 34 below.

Figure 34: Primary objective response



Source: Author (2021)

The following section asserts the negative effects of refractory imports on the operations values chains.

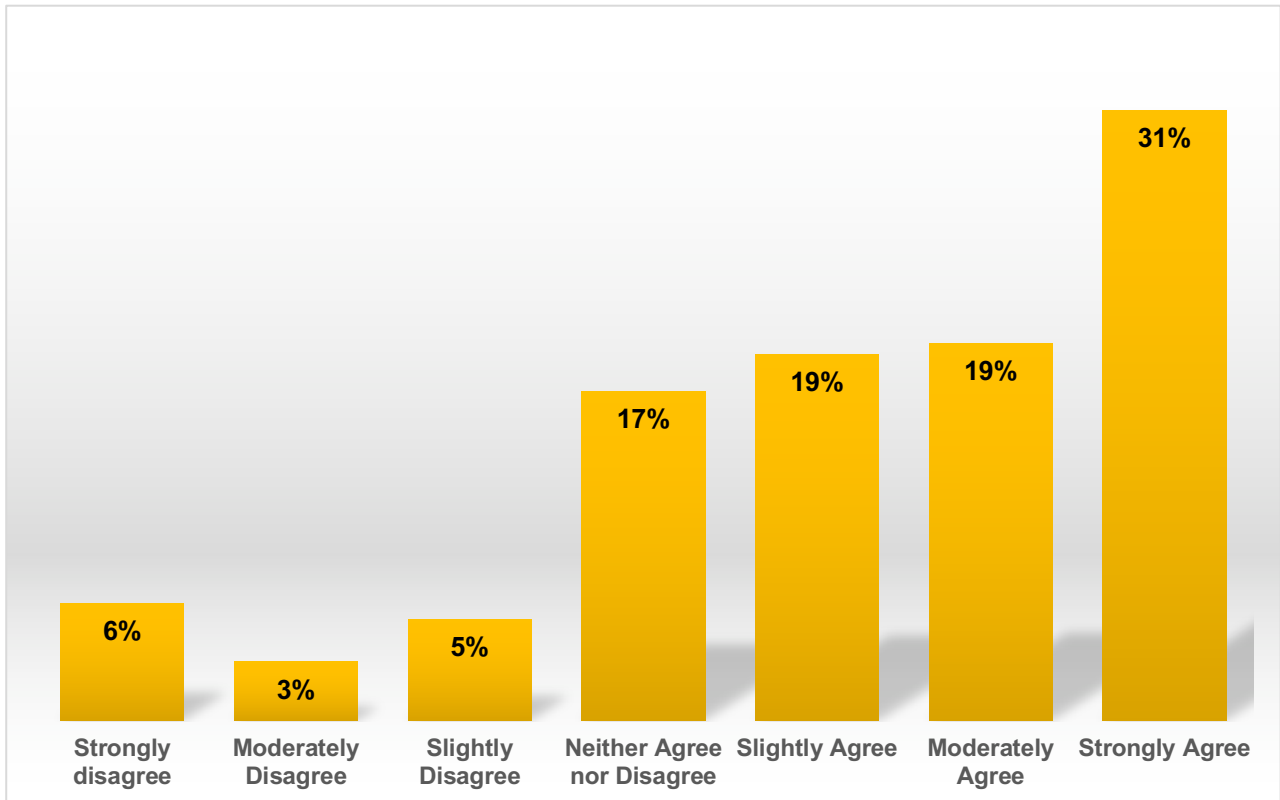
4.8.1 The effects on sales and market share

Considering the statements regarding sales and market share, the lowest mean was reported for B5 stating that “The market share of local brick manufacturers has increased in South Africa over the past 15 to 20 years” (mean = 2.51; SD = 1.41), indicating that respondents on average slightly disagree to neither agree nor disagree with this. The highest mean was reported for B3 “Brick importers have gained market share in recent years” (mean = 6.03; SD = 1.24), indicating that respondents on average moderately agreed with the statement. This reflects that respondents on average feel that the sales and market share of the local refractory producers has declined over the past 15 to 20 years.

The entire sales and market share construct attained a mean score of 5.30, meaning that respondents slightly agreed on the negative effects of imports on the sales and marketing function. Figure 35 below displays the range of responses to the entire construct. About 31% of the respondents strongly agreed, 19% moderately agreed and another 19% slightly agreed with the negative correlation of imports on the sales revenue, sales volumes and

market share of local players. The findings illustrate that about 69% of respondents agreed on the effects of imports.

Figure 35: Sales and market share overall response

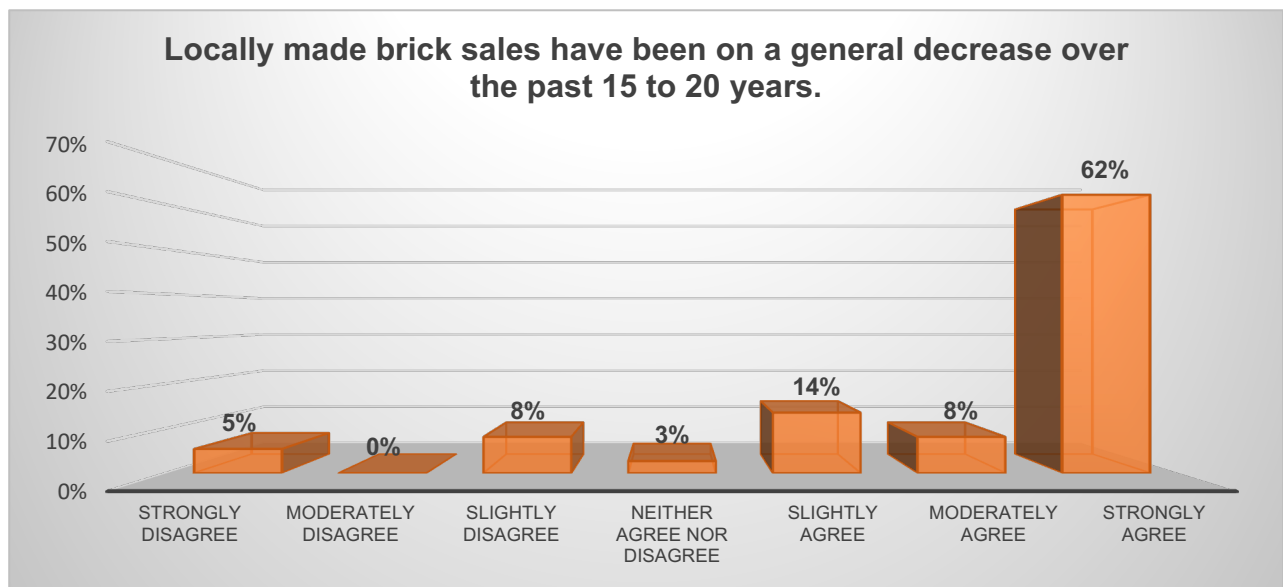


Source: Author (2021)

4.8.2 Sales

Sales revenue is critical to the growth and sustenance of any functional business entity. In order to ascertain the effects of refractory imports on the sales revenue, the respondents were asked if local bricks sales have been on a general decrease for the past 15 to 20 years. The findings prove that 62% strongly agreed, 8% moderately agreed and 14% slightly agreed. In summary, about 84% agreed that the sales revenue has been on a decrease over the period under review. It may be concluded that most respondents apportioned the decline of sales to the impact of refractory imports in the country, as depicted by Figure 36 below.

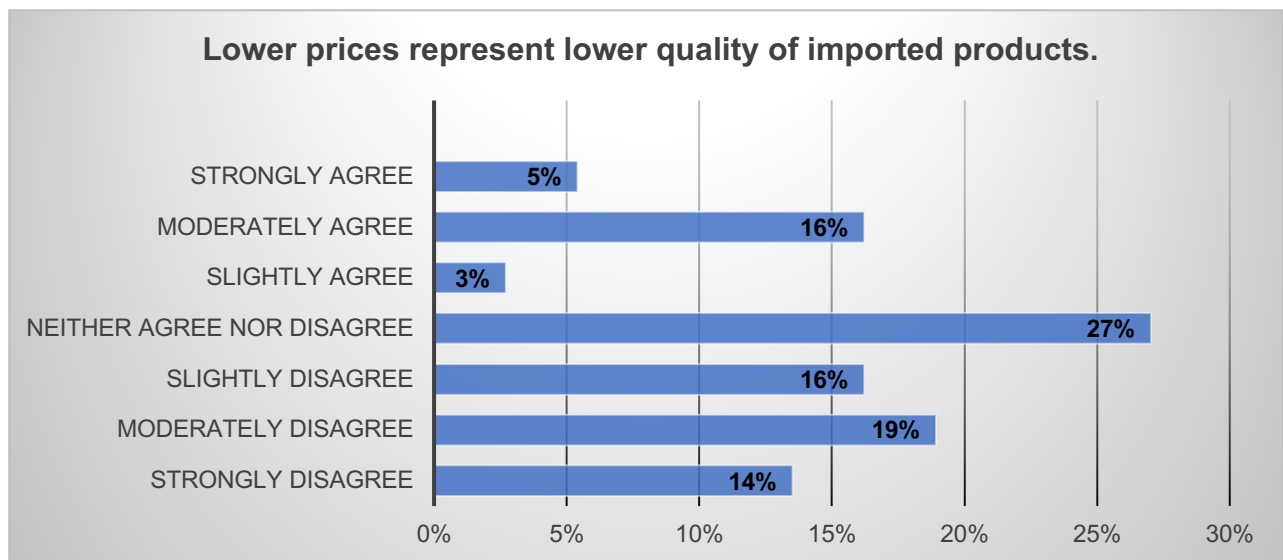
Figure 36: Decline of local brick sales



Source: Author (2021)

A particularly interesting observation was noted on the statement regarding the lower prices of imported bricks. The statement aimed to enquire whether lower prices always represented lower quality of imported products. The responses were normally distributed across the continuum with the highest proportion of people neither agreeing nor disagreeing at 27%. In total, 49% disagreed, comprising 16%, 19% and 14% slightly disagreeing, moderately disagreeing and strongly disagreeing, respectively. The mean score of 3.57 was recorded meaning that respondents slightly disagreed to neither agreed nor disagreed with the statement. This observation indicates that lower prices of refractory imports are not reflective of lower quality products. The observation is clearly illustrated by Figure 37 below.

Figure 37: Quality of Imported products

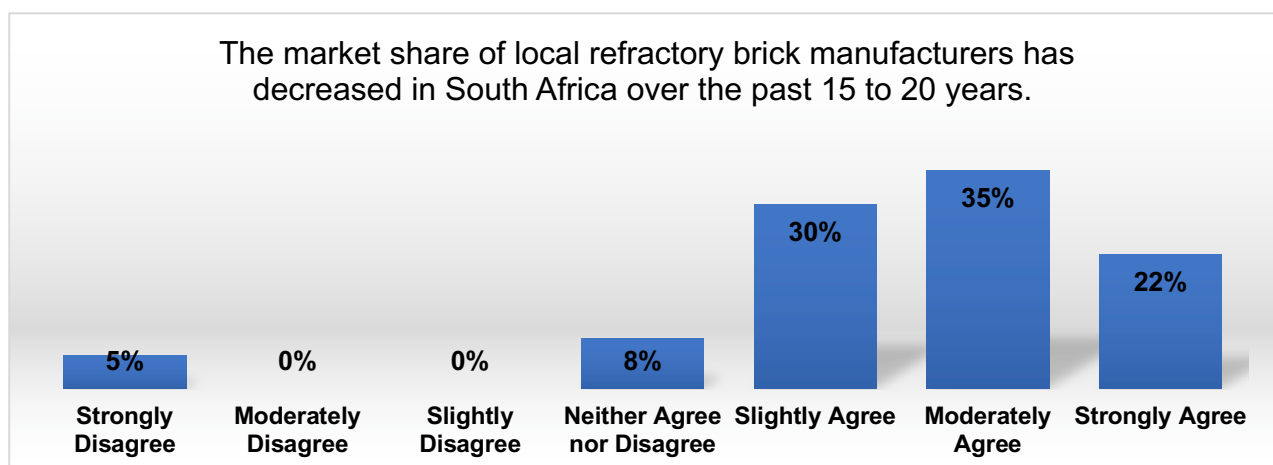


Source: Author (2021)

4.8.3 Market share

Market share defines the portion of the market that is controlled by a specific company or product. Market share is a critical indicator of market competitiveness as it demonstrates whether forecasts are achieved by growing with the market or by capturing from competitors (MASB,2021). The second portion of the sales and market share construct assessed if there was any change in the market share of local manufacturers and that of importers. The findings are presented in Figures 38 and 39, respectively.

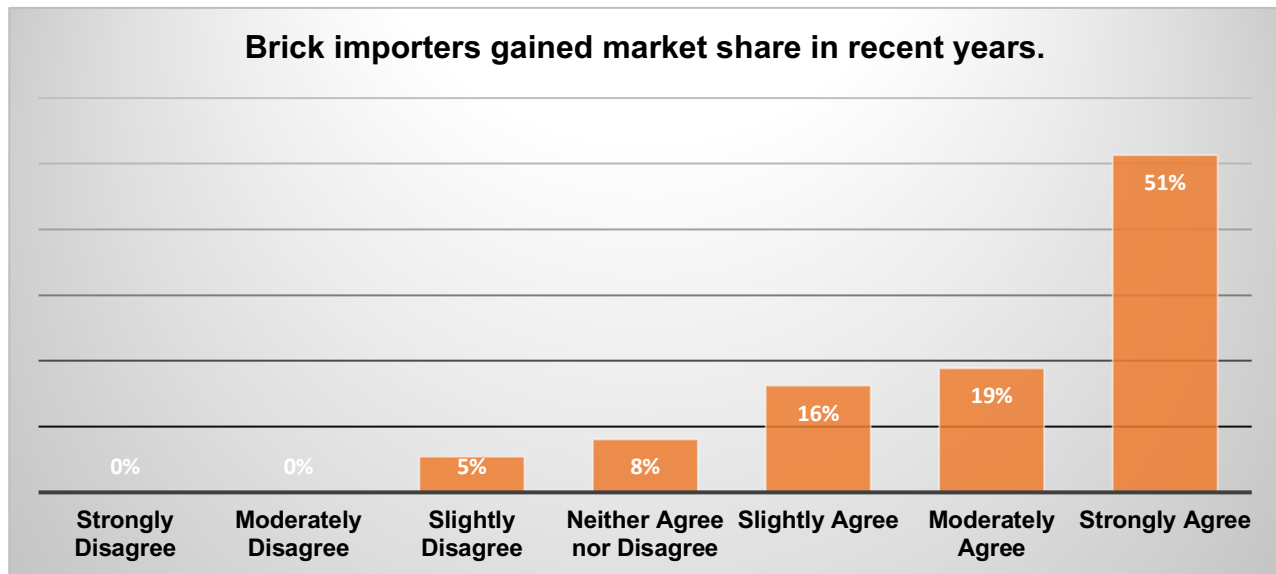
Figure 38: Market share of local brick producers



Source: Author (2021)

In total, 87% agreed, comprising 30%, 35% and 22% slightly agreeing, moderately agreeing and strongly agreeing, respectively. The mean score of 5.49 was recorded meaning that respondents slightly to moderately agreed with the statement.

Figure 39: Market share of refractory brick importers



Source: Author (2021)

The findings indicate a mean score of 6.03, with 51%, 19% and 16% of responses ranging from strongly agree, moderately agree and slightly agree, respectively. In total, 86% of respondents agreed that the brick importers gained market share in South Africa in recent years. This presents a positive correlation between the quantity brick imports and the local market share of brick importers.

4.8.4 The effects on production output

The third secondary objective related to the effects of refractory imports on the production throughput and output of the local brick producers. Various questions probed the challenges faced by the production function and whether the respondents agreed or disagreed. The questions pertained to general production output over the past 15 to 20 years, the operational changes, the level of demand for various brick shapes and specific brick types. The results indicate a mean score of 4.92, with 21%, 15% and 17% of responses ranging from strongly agree, moderately agree and slightly agree, respectively.

The mean score illustrates that the respondents slightly agreed on the negative effects of refractory imports on the production output and throughput of the local manufacturing firms.

It may be noted that among the measured factors, this construct ranked with the lowest mean score, indicating that the assessed perceived effects on production output may be lower compared to the effects of sales, market share, capacity utilisation and manpower. Table 13 provides the pictorial depiction of the overall responses on the production output construct.

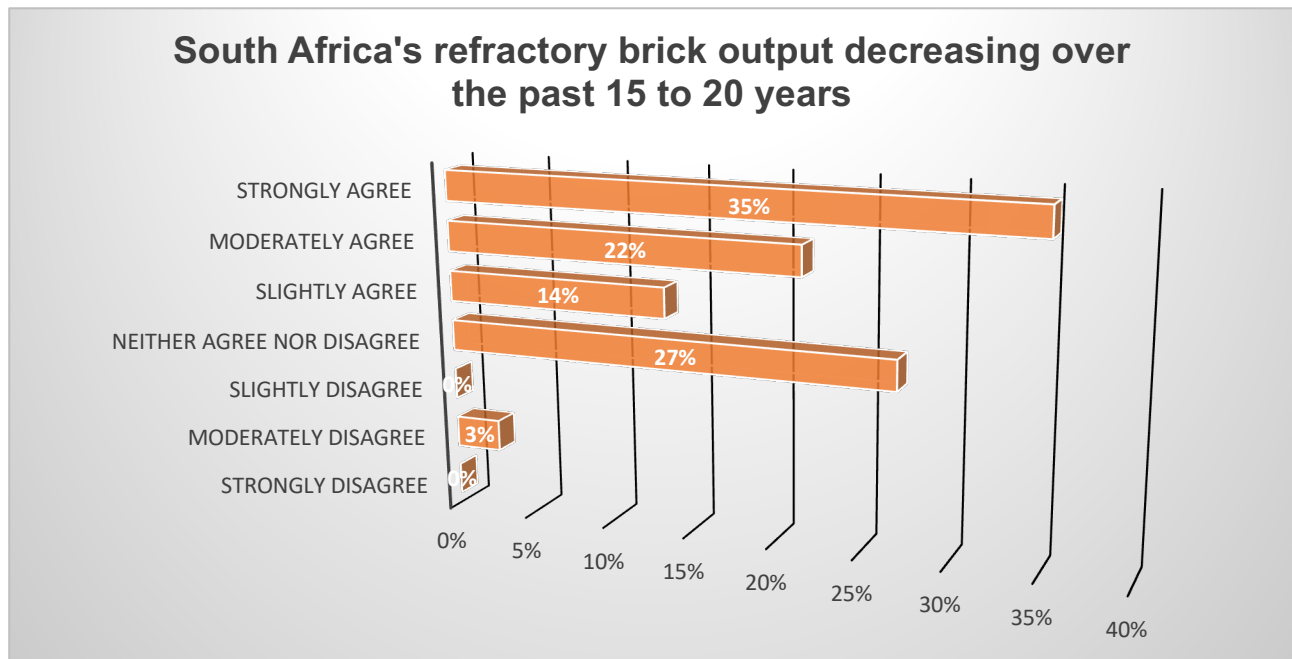
Table 13: Effects on production output

Response type	Strongly disagree	Moderately disagree	Slightly disagree	Neither agree nor disagree	Slightly agree	Moderately agree	Strongly agree
Percentage	1%	3%	9%	34%	17%	15%	21%

Source: Author (2021)

In order to clearly assess the status of production output over the past 15 to 20 years, respondents were asked to respond regarding the decreasing production output. The below graph (Figure 40) provides a summary of the findings. The results indicate a mean score of 5.57 with 35%, 22% and 14% of responses ranging from strongly agree, moderately agree and slightly agree, respectively. The lowest mean score was recorded on the statement “The demand for some bricks shapes by local customers has been on a general decrease”, with a mean score of 4.54. This illustrates that the demand for brick shapes has not been too significantly affected compared to the production output and operational changes made in the plants.

Figure 40: Refractory brick output for South Africa



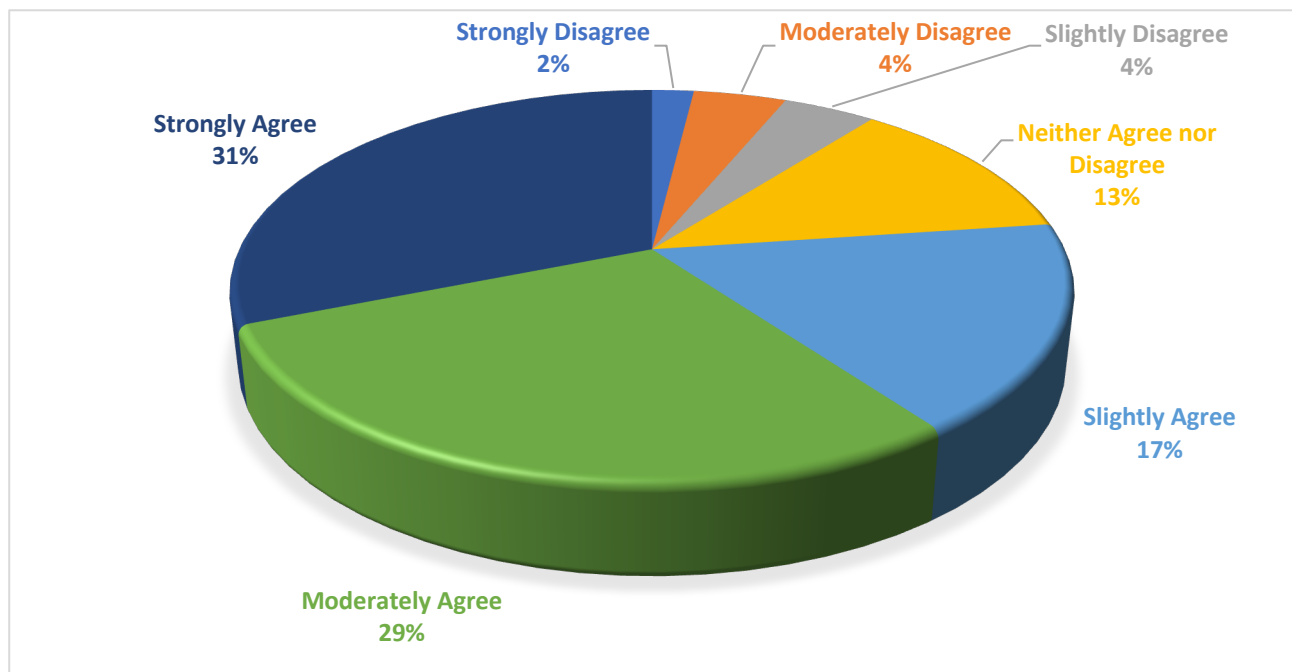
Source: Author (2021)

4.8.5 Effects on capacity utilisation

In a purely technologically determined primal measure, capacity refers to the maximum possible output that could be produced utilising the available technology, capital, and the full and technically efficient utilisation of the variable inputs (FAO,2021). Capacity utilisation determines how much of the firm's production capacity is being utilised. In order to ascertain the effects of refractory imports on the capacity utilisation of local manufacturing firms, the respondents were probed with five statements.

The lowest mean was reported for C5 stating that "The capacity utilization of the brick plant has been on general increase in recent years" (mean = 2.38; SD = 1.48), indicating that respondents on average moderately agreed with this. The highest mean was reported for C6 "The local brick making plants sometimes operate intermittently due to low demand" (mean = 5.62; SD = 1.40), indicating that respondents on average moderately agreed with the statement. The overall mean score of 5.54 moderately agrees and reflects that respondents on average perceived that the capacity utilisation of the local refractory producers declined over the past 15 to 20 years. Figure 41 below shows the overall responses of the participants.

Figure 41: Effects on capacity utilisation



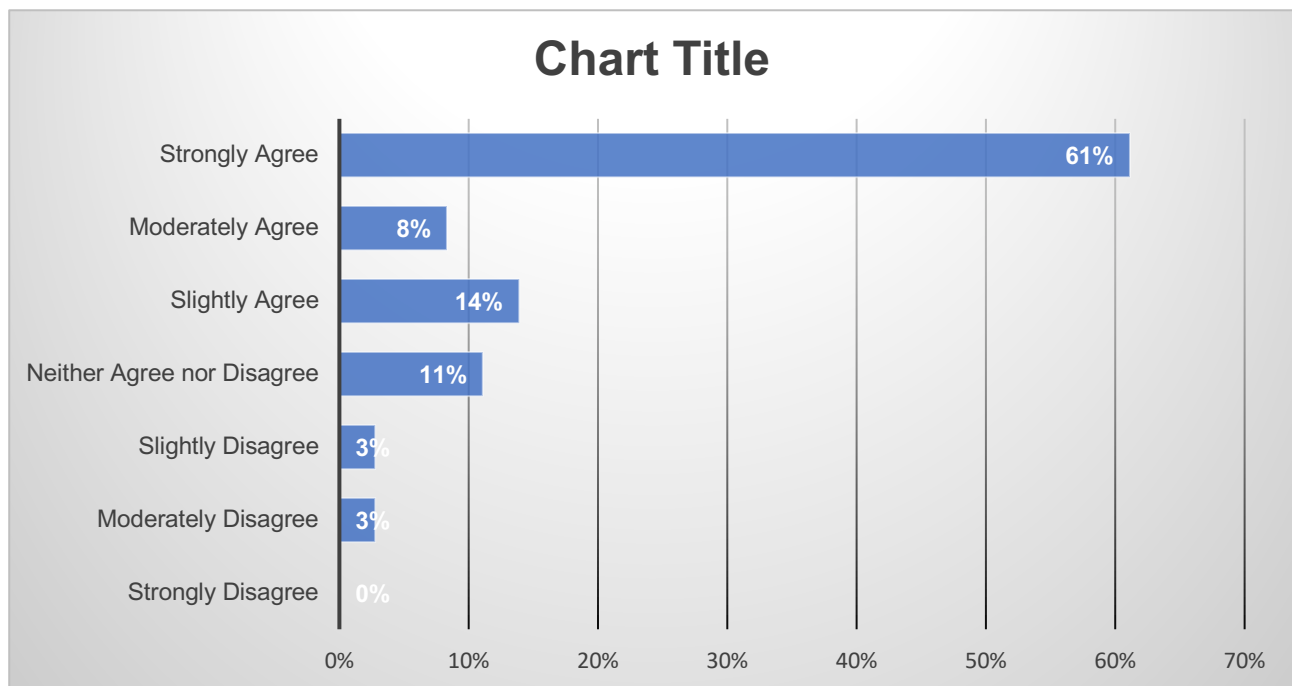
Source: Author (2021)

4.8.6 Effects on the job market

Considering the statements pertaining to refractory job market, the lowest mean was reported for D4 stating that “The brick making industry did not need to make changes to the shifts to adjust for the low demand” (mean = 1.81; SD = 1.10) indicating that respondents on average strongly disagreed to moderately disagreed with this. The highest mean was reported for D3 “Some jobs in the local brick making plants are under threat” (mean = 5.73; SD = 1.43), indicating that respondents on average Moderately Agreed with the statement. This reflects that respondents on average perceived that the companies made some changes to the working shifts in order to cope with the change in demand. Furthermore, this illustrates that the respondents perceive that some jobs are under threat due to the impact of refractory imports on local producers.

To further assess the effects of refractory import on the labour market, the respondents were also asked if the local brick making job market has been shrinking over the years. About 61% strongly agreed, 8% moderately agreed and 14% slightly agreed. There is a big difference between agreeing (83%) and disagreeing (6%) that the job market has been significantly impacted by refractory imports. Figure 42 below presents the negative effects on the job market.

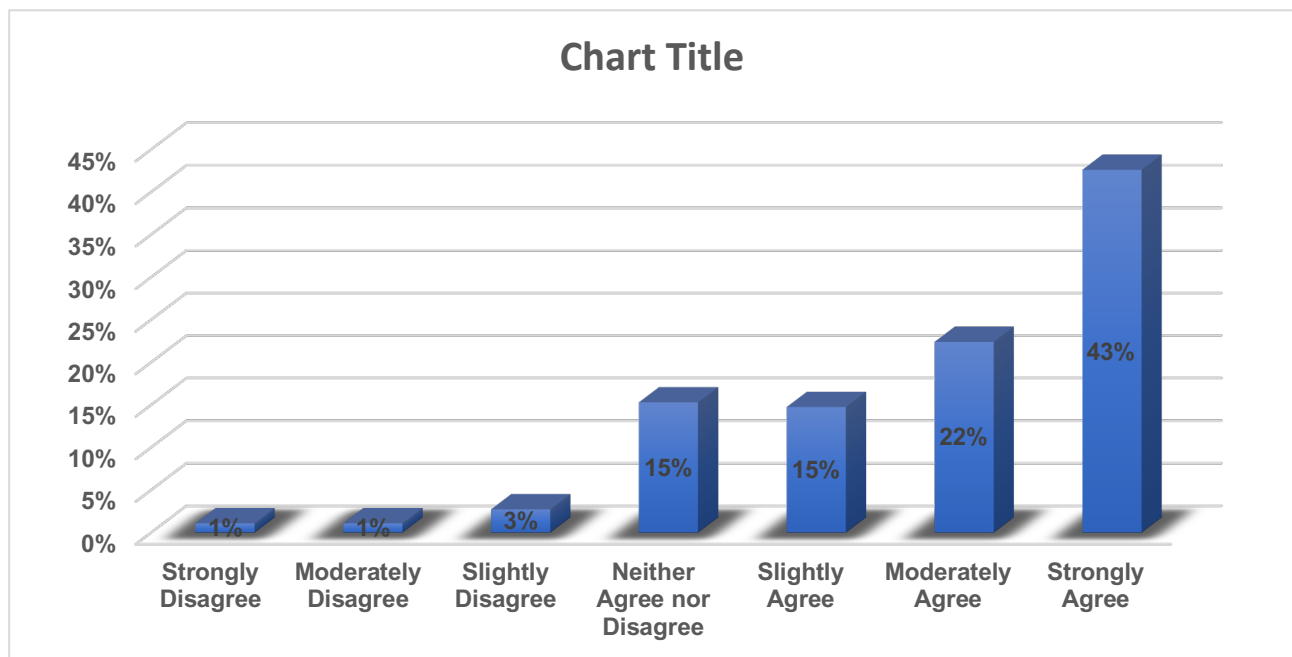
Figure 42: The negative effects on the job market



Source: Author (2021)

The overall perceived effects on the manpower, job market and employment are depicted by the mean score of 5.78, with a standard deviation of 1.03. This depicts that generally the respondents moderately agreed that the negative effect of 82.5% was attributable to the refractory imports. The detailed Figure 43 below presents the overall summary of results for the perceived effects on manpower and the job market.

Figure 43: Overall perceived effects on manpower and job market



Source: Author (2021)

4.9 Summary of the findings

Assessment of the effects of refractory imports on the local refractory brick producers was the primary objective of the study. This included identification and evaluation of the extent to which the local brick manufacturers in South Africa have been impacted by the presence of refractory brick imports on the local market. To effectively respond to the primary research question, a few constructs were included that related to the operational value chains of the local producers. Furthermore, secondary data was analysed relating to the historical trend of imported refractory bricks over the 15- to 20-year period.

Analysis of the trend of refractory imports indicated that 79% of the annual period under review showed significant import volume increases with peaks of 27% in 2006, 56% in 2008 and 80% in 2018. In conclusion, a notable trend of increases in volume and value of imported refractory bricks exists. This remarkable increase has an unpropitious direct impact on the South African market conditions and operations of the local refractory brick manufacturing firms.

The overall effects of refractory imports on the local refractory brick producers may be denoted by mean score of 5.39, denoting that respondents slightly agreed (77%) that local

brick manufacturers have been negatively impacted by the persistent market presence of imports. The findings highlight that about 28% strongly agreed, 16% moderately agreed and 13% slightly agreed. In summary, about 54% agreed that imports have detrimental effect on the local producers, while 8% of the respondents disagreed. In conclusion, the impact is very significant and evident.

The secondary research objective pertained to investigating a comprehensive set of critical factors and value chains influencing operations performance in the refractory industry, and to what extent these factors are influenced by import statistics of refractory bricks in the market. The value chains and critical success factors that were identified include sales, market share, production output and throughput, capacity utilisation, human resources, employment levels and labour turnover.

The findings for sales prove that 62% strongly agreed, 8% moderately agreed and 14% slightly agreed. In summary, about 84% agreed that the sales revenue has been on a decrease over the period under review. It may be concluded that most respondents attributed the decline in sales to the effect of refractory imports. The respondents indicated a mean score of 6.03 for market share, with 51%, 19% and 16% of responses ranging from strongly agree, moderately agree and slightly agree, respectively. In summary, 86% of respondents conclusively agreed that the brick importers have gained market share in South Africa in recent years. This notion presents a positive correlation between the bricks imported and the local market share of importers.

Regarding production output, the results indicate a mean score of 4.92 with 21%, 15% and 17% of responses ranging from strongly agree, moderately agree and slightly agree, respectively. The scores illustrate that the respondents slightly agreed with the negative effects of refractory imports on the production output and throughput of the local producing factories. The production output factor ranked with the lowest mean score, indicating that the assessed perceived impact on production output is lower compared to the effects on sales, market share, capacity utilisation and manpower. The overall mean score for capacity utilisation was 5.54, moderately agreeing and reflecting that respondents on average perceived that the capacity utilisation of the local refractory producers declined over the past 15 to 20 years.

The overall perceived effects of the manpower, job market and employment denoted a mean score of 5.78 with a standard deviation of 1.03. This indicated that generally the respondents

moderately agreed that the negative impact of 82.5% was attributable to the refractory imports. This construct depicted the changing job market, employment levels and conditions of employment. The last secondary objective related to the drafting of recommendations on what strategies the industry may employ to foster growth, remain competitive, sustainable and retain the existing market share. The next chapter will provide information pertaining to the recommendations for the refractory industry and areas of future study.

4.10 CONCLUSION

The main objective of this chapter was to provide comprehensive findings of the data analysis, and to respond to the primary and secondary research questions. The primary data was collected from the respondents, collated and analysed using SPSS. A satisfactory response rate of 74% was attained. Secondary data relating to the refractory imports statistics was obtained from the Department of Trade Industry and Competition South Africa. The secondary data was analysed with historical and current trends identified. The effects of refractory imports were assessed based on the responses to the various value chains and key performance indicators such as sales, market share, production output, capacity utilisation and manpower. The chapter was effective in responding to the primary and secondary objectives while answering the research questions. The following chapter provides a detailed, comprehensive conclusion and recommendations.

5 CHAPTER 5: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter outlines the conclusions and recommendations pertaining to the research study and objectives. The chapter provides a comprehensive summary of the study and lays the background for future research. The section furnishes valuable insight on the recommendations for the refractory industry. The research primarily focuses on assessing the effects of refractory imports on the local manufacturing firms. The summary of the research is presented in the following section.

5.2 Summary of findings

The immense competition due to international trade is bedevilling various industrial sectors within the African continent. Numerous South African manufacturing industries are bearing the brunt of this inapt predicament. While the local consumer is now privileged with significant benefits due to increased choice, the plight of many local industries such as refractory producers might not be fully understood. Therefore, it was imperative for this study to interrogate the effects of imported refractory bricks on the operations of the local refractory brick manufacturing companies. To thoroughly exhaust the subject, the following secondary objectives were identified:

- To assess the challenges faced by refractory producers in South Africa due to trade.
- To empirically assess and establish the extent that operational value chains of local refractory brick producers are influenced by the quantity of imports of refractory bricks in the market.
- To draw up conclusions and recommendations on strategies the industry may employ to remain competitive and sustainable, retain existing market share and foster growth.

5.2.1 Chapter 1

Chapter 1 lay a solid background on the increased global competition and the need for any business, academic, management, public and private organisational institutions to note the paradigm shift and dynamic changes in particular industries due to the impact of increased merchandise importation. According to a study by Mogoe (2014:7) on the impact of foreign trade on economic growth in South Africa, inflation rate, exports and exchange rate are positively related to GDP, while imports have a negative influence on GDP (Mogoe, 2014).

A notion exists that cheap imported products contribute to the undermining of development in Africa by prohibiting and thwarting growth of the manufacturing sector, which would have created jobs and wealth under normal circumstances (Mazo & Munapo, 2017). The perceived notion within the refractory industry is that imports of refractory bricks have an adverse and unpropitious impact on the local manufacturer's competitiveness. The South African refractory industry is faced with the ever-growing challenge of refractory imports, catapulted with a shrinking local market. Consequently, this study aimed at investigating the core research question on how imports of refractory bricks into South Africa affect the operations of the local brick manufacturers.

The primary objective of the study was to identify and evaluate the extent to which the local brick manufacturers in South Africa have been impacted by the presence of refractory brick imports in the local market. The secondary objectives were crafted to establish the challenges faced by refractory producers in South Africa due to trade; to assess and establish the extent that operational value chains of local refractory brick producers are influenced by the quantity of imports of refractory bricks in the market; and to draw up conclusions and recommendations on what strategies the industry may employ to remain competitive and sustainable, retain existing market share and foster growth.

In order to assess the extent to which the local brick manufacturers in South Africa have been affected by the presence of refractory brick imports in the local market, an empirical research design was used for this study. This research study followed the positivism epistemology, a deductive design, approach and reasoning. A questionnaire was designed and utilised for the primary data collection. A study of the local refractory brick manufacturing companies in Gauteng was performed to fully assess the influence of brick imports. This was achieved using the quantitative research approach.

The results of this study will assist the refractory manufacturing industry to encapsulate the current situation holistically based on the applied structured approach with detailed findings. The results and recommendations will stimulate effective, strategic, sound and tactical decision-making responses to the imports within the refractory manufacturing sector. The research will add to the existing body of knowledge by providing valuable insight into the relationship between imported goods and their impact on local operations in the refractory manufacturing industry.

5.2.2 Chapter 2

The literature review provides an overview in descriptive format of the published literature including the most relevant to topics while clarifying the argument framework. In order to effectively analyse the effects of imports on refractory manufacturing companies, critical literature was reviewed on globalisation, international trade, South Africa's trade balance, the global refractory industry, the refractory industry in South Africa and the factors affecting organisational market performance.

This chapter also provided a detailed review of the literature and established the challenges faced by refractory producers in South Africa due to trade. The descriptive analysis of the global refractory brick trade, refractory global supply chains and competitors brought the challenges faced by local producers to the fore. The chapter uncovered evidence for the secondary research objective of assessing the challenges faced by local refractory brick producers in South Africa due to trade. This challenge included but are not limited to a shrinking local market, reduced sales, reduction in production throughput, closure of some refractory producers, lower employment levels and a reduction in capacity utilisation. The section also identified the gaps in the existing body of knowledge pertaining to the refractory industry and the effects of imports on the local industries.

5.2.3 Chapter 3

Chapter 3 outlined the methodology utilised during the research study. The research approaches and data collection methods were presented. The study population, sample and sampling strategy were clearly elaborated on. The chapter also included the ethical considerations, the reliability and validity, the data collection process and capturing, as well as statistical analysis.

5.2.4 Chapter 4

Chapter 4 presented the results, discussions and interpretation of findings of the secondary data and empirical study. The chapter's core focus was to address the secondary research objective by empirically assessing and establishing the extent that operational value chains of local refractory brick producers are influenced by the quantity of imports of refractory bricks in the market.

The first section provided the analysis of secondary data from the Department of Trade Industry and Competition, relating to the quantity of imported refractory bricks for the period

under review. The second section presented the demographic information including the response rate. The third section furnished the analysis that sought to fulfil the primary research objective of identifying and evaluating the extent to which the local brick manufacturers in South Africa have been impacted by the presence of refractory brick imports in the local market. The last section offers an analysis and discussion on answering the secondary research questions and fulfilling the secondary research objectives. The results of each response category and construct were discussed and interpreted. Tables, pie charts, bar charts and histograms were employed to present and interpret the data analysis.

The research was subject to a sample of 50 individuals with 37 successful respondents, highlighting a 74% response rate. According to the Department of Trade Industry and Competition, for the period under review from 2000 up to 2019, refractory brick imports showed a significant and gradual increase with about 79% data points showing significant import volume increases with peaks of 27% in 2006, 56% in 2008 and 80% in 2018. According to the empirical evidence gathered, the respondents clearly noted the negative correlation between the quantity of imported refractory bricks and the operational challenges of the local producers in South Africa.

The perceived effect on sales and marketing was noted as negative 75.7 percent while production output was negative 70.3 percent. The findings indicated a resultant reduction in market share for the local producers and the negative impact on overall production throughput. The perceived effect on capacity utilisation was denoted as negative 79.2 percent, while the manpower construct was negative 70.3 percent. The overall or average perceived effect of refractory brick imports on the operations of the local producers in South Africa was negative 76.92 percent. This negative correlation is very high and ultimately unsustainable for the local refractory brick producers.

5.3 Recommendations

The findings of this study highlight the overall negative effects of refractory bricks imports on the operations of local producers. The negative effects and challenges faced by the local refractory industry remain a fundamental issue to be resolved. One of the critical secondary research objectives is to draw up conclusions and recommendations on what strategies the industry may employ to remain competitive and sustainable, retain existing market share

and foster growth. The following section provides the recommendations pertaining to the refractory industry, private and public sectors, policy-makers and scholars.

5.3.1 Refractory industry

The findings highlight immense pressure from the presence of refractory bricks on the local market. It is imperative for the local refractory industry to analyse the historical secondary data on refractory brick imports and be able to strategise and make informed decisions pertaining to the following:

▪ Sales

The findings provide evidence relating to refractory brick import trends. The managers and leaders within the refractory industry will be able to clearly identify and compare the industry trends with respect to sales and sale growth initiatives. The recommendation for the sales function is the immediate need for planning and decision-making in order to address the market concerns and foster growth. Refractory firms should consider an overall marketing strategy re-evaluation of the core products, promotion, pricing and distribution. The adjustment of the marketing mix will offer valuable insights to counter the effects of the imports. The following steps and actions may be considered:

- Product: evaluate the strategies for the entire product lifecycle, consider offering alternative products that might be price competitive, review the product portfolio and perhaps discard worse performing products and finally reassess the overall product strategy.
- Price: review the pricing strategies and select the best fit for the current industry trends such as market penetration, profit maximisation, mark-up pricing and status quo.
- Distribution: review the distribution options and foster efficient and cost-effective distribution solutions in order to counter the foreign competition. The review can include warehousing, materials handling, transportation and marketing channel strategies.
- Promotion: review the promotion efforts in light of the intense competition from imported refractory bricks. The assessment should involve advertising, public relations, sales promotions and personal selling.

▪ **Market share**

The empirical evidence clearly established the reduction in market share of local producers. This research furnishes managers and leaders within the refractory industry with the dynamics of market share based on the imported quantities of refractory bricks. It is imperative for refractory brick manufacturing firms to devise strategies to regain the lost market share, defend the territory and foster market share growth. It is highly recommended for the practitioners to utilise the Ansoff matrix for market development and diversification. The current pressure on the local market also presents an opportunity for the industry to seek other geographic market opportunities in order to sustain the required plant loading and capacity utilisation. The geographic market of primary consideration encompasses primarily the entire African continent. The prevailing drive for free trade in Africa provides greater competitive advantage for the local South African producers.

▪ **Production operations**

It is imperative to review the production facilities, processes and systems of key competitors and identify their strengths and weaknesses. The competition analysis will be followed with implementation of the latest technological, process and systems best practices. The identified areas of weakness and recommended changes may include plant utilisation, plant loading, production throughput, plant equipment, investment in new equipment, manufacturing philosophy to address effects of foreign competition on the local market. It is worth noting that numerous firms have employed lean manufacturing principles that enable business to increase production, reduce cost and improve profits.

▪ **Human resources**

The investigation offered vital managerial insights regarding the effects of the market changes on the refractory industry job market. It is imperative for organisations to perform a skills audit in order to assess if the requisite critical skills are still existing within the refractory industry. The shedding of jobs and closure of Vereeniging refractories are a worrying sign for the refractory industry, should the current trend of imports continue unabated.

5.3.2 Private sector

The refractory brick manufacturing industry within South Africa is based on an oligopoly market structure and has been for many years, with fewer than five local manufacturers. The introduction of additional competitors in local markets through direct imports and foreign

competitors eliminates the significant barriers of entry such as capital extensive investments on new equipment. The resultant market structure shifts to a monopolistic competition or pure competition. The continuous import of merchandise into South Africa is diverse and also includes a vast number of locally manufactured products. It is critical for other private sector firms to take note of such case studies in order to identify the early warning signs, learn from the different industrial sectors and employ strategies to respond swiftly to market shifts or anticipated market shifts.

5.3.3 Government and policy-makers

The investigation offered invaluable insights regarding the effect of the imports on the concept of deindustrialisation and unemployment in South Africa. According to Imbs (2013), there is evident deindustrialisation of the South African economy, suggesting that trade, both local and global, contributes to the structural change from manufacturing to services, which leads to higher unemployment rates. The structural shift to services does not support more employment, but rather tends to favour a leaner structure. It is critical for government and policy-makers to note the detrimental effects of free trade on the local manufacturing industry, employment rates and society at large. It is the author's hope that this addition and contribution to literature on the effects of trade will foster changes, restrictions and protectionist policies on import of certain locally manufactured products.

Based on the reviewed literature in Chapter 2, it is worth noting that South Africa has one of the lowest import tariffs on refractory bricks compared to other refractory manufacturing countries. According to the OEC (2021), South Africa is the biggest importer of refractory bricks in Africa, comprising US\$14 million in 2019. The mean global tariff on refractory bricks was 6.35% in 2019, with the highest recorded in Angola at 50 percent, the Bahamas at 29.4 percent and Sri Lanka at 25.6 percent (OEC (2021)). South Africa's tariffs on refractory brick imports range from 0% to 0.722%, which is very low and well below the mean global tariffs for refractory bricks. It is the author's hope for policy-makers to review and increase the tariffs of refractory bricks imports to at least the global mean in order to protect the local refractory brick manufacturing firms.

Table 14: Study recommendations

Sectors	Objective	Implementation timeframe	Responsible function	Resources
Refractory Industry	Consider new marketing mix strategies for increasing turnover	Short term	Sales function	Marketing budget
	Explore new markets in sub-Saharan Africa	Short term	Sales function	Marketing budget
	Employ lean manufacturing principles	Short term	Operations	Investment for training and development
	Perform skills audit	Short term	Human resources	Consultant or human resource staff
Private Sector	Employ strategies to respond swiftly to market shifts or anticipated market shifts.	Short and long term (based on the market swings)	Private sector such as manufacturing industries	Strategy formulation and resources such as manpower, machinery and capital
Government and Policy Makers	Foster restrictions and protectionist policies on imports	Short term	Policy-makers	Parliament

Source: Author (2021)

5.4 Achievement of the objectives of the study

The research study achieved the objectives that were set out in Chapter 1. The objectives included the following:

- To assess the challenges faced by refractory producers in South Africa due to trade.

Chapter 1 and Chapter 2 provided the background and literature review of the study. Chapter 1 provided a foundation regarding the status of the refractory industry and depicted the prevailing circumstances due to the effects of refractory brick imports. These challenges include reduced market share, sales, profitability, local competitiveness, capacity utilisation, production throughput and higher unemployment levels. Chapter 2 provided literature to identify the gaps in the existing research while providing more insight regarding the global and local refractory industry. The chapter also furnished more insight such as South Africa's trade imbalance, refractory brick trade and competition. In conclusion, the objective of assessing the challenges faced by refractory producers was met and exceeded to a large extent.

- Chapter 4's core focus was to address the secondary research objective by empirically assessing and establishing the extent that operational value chains of local refractory brick producers are influenced by the quantity of imports of refractory bricks in the market. The perceived effect on sales and marketing was noted as negative 75.7 percent, while production output was negative 70.3 percent. The perceived effect on capacity utilisation was denoted as negative 79.2 percent, while the manpower construct was negative 70.3 percent. The overall or average perceived effect of refractory brick imports on the operations of the local producers in South Africa was negative 76.92 percent. This negative correlation is very high and ultimately unsustainable for the local refractory brick producers. Based on the established findings, the research met the objective by identifying the influence of the quantity of imported refractory bricks on the local market.
- To draw conclusions and recommendations on what strategies the industry may employ to remain competitive, sustainable, retain existing market share and foster growth, Chapter 5 provided the conclusions and recommendations for the various stakeholders. Recommendations were drafted for the refractory industry, private sector, government and policy-makers. Detailed recommendations based on facts were presented for appropriate actioning.

5.5 Recommendations for future research

The research will add to the existing body of knowledge for academics and industrialists including scholars, economists, sales practitioners and the refractory industry. The investigation unearthed a critical notion pertaining to the perception of the quality of imported products in relation to price competitiveness. It is worth investigating the perceived quality of the imported merchandise from the end users' point of view.

Secondly, the import tariff difference on refractory bricks between South Africa, other African countries and the rest of the world requires additional research. It will be highly commendable to assess market pressures exerted on some of the high employing and critical industrial sectors due to imports. The assessment will encompass the South African tariff trends against global trends. The research will aim to highlight the plight of critical industrial sectors in the country due to international trade.

5.6 Conclusion

This section provides a conclusion to a thrilling, informative and highly explorative study regarding the effects of trade on the refractory industry in South Africa. The dawn of the 21st century was an era of transformation due to rapidly evolving technologies. Globalisation ranks highly among the advent of internet, increased internet connectivity and technological advancement in computers and smart phones. The positive attributes of globalisation can never be underestimated, ranging from free trade, free labour movement, increased economies of scale, greater competition and increased investments. The excellent concept of globalisation has created many winners and unfortunate losers. The regrettable costs encompass the harm that free trade imparts on developing economies with infant industries.

Literature possesses vast opinions on the effects and impact of trade on first world and developing countries. Although vast literature exists and various stakeholders have vacillating opinions on trade, it is imperative to conduct research on the effects of international trade on the local industries that might be extremely vulnerable, if not protected by the government through sound policy-making and implementation of regulations. According to Statista (2021), 5.28 percent of employees in South Africa were active in the agricultural sector, 22.31 percent in industry and 72.41 percent in the service sector in 2019. It remains imperative to protect the critical sectors of the economy such as agriculture and industry as they contribute immensely to employment creation.

This research study highlights the plight of the refractory industry due to imports. Numerous industrial sectors might be experiencing similar circumstances and challenges, while some might be facing closure. The critical nature of these challenges cannot be underestimated as the respondents agreed on a negative impact on the local producers' operations of up to negative 76.92 percent. The results have brought the demerits of economic globalisation in developing nations to the fore, as mentioned in Chapter 2. These include the resulting suppression and even elimination of some national markets due to trade, asymmetric shocks such as the duality of work and unemployment, and unfair advantages of multinationals due to economies of scale. It remains to be noted, how the refractory industry will be able to weather the imports storm without policy protection from the South African government.

The prevailing Covid-19 pandemic adds to the pre-existing strain and pressure due to imports. It is more critical than ever for the refractory industry to adopt highly competitive strategies that foster growth, mitigate the effects of imports and thwart foreign competition by taking advantage of other competitive advantages such as local raw materials and closer proximity to customers.

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ANNEXURES

APPENDIX A: LANGUAGE EDITING CERTIFICATE

To whom it may concern

Cecile van Zyl
Language editing and translation
Cell: 072 389 3450
Email: Cecile.vanZyl@nwu.ac.za

6 December 2021

Dear Mr / Ms

Re: Language editing of mini-dissertation (Assessing the effect of imports on refractory brick manufacturers in South Africa)

I hereby declare that I language edited the above-mentioned mini dissertation by Mr Brighton Mapiku (student number: 3339384).

Please feel free to contact me should you have any enquiries.

Kind regards



Cecile van Zyl

Language practitioner

BA (PU for CHE); BA honours (NWU); MA (NWU)
SATI number: 1002391

APPENDIX B: RESEARCH QUESTIONNAIRE

SECTION A: DEMOGRAPHICS

Instructions: Using the provided options, indicate your response to each item. Please answer all the questions honestly and accurately by making a cross in the appropriate box. If you make a mistake, just draw a line through the cross and make a new cross in the selected box.

1. Gender

Male	Female	Prefer not to indicate
1	2	3

2. Years of experience in refractory industry

0-5	1
6-10	2
11-15	3
16-20	4
21-25	5
26 and more	6

3. Department

Operations	Sales and marketing	Human resources	Finance	Research, development, quality and technical	Other
1	2	3	4	5	6

4. Years in current position

0-5	1
6-10	2
11-15	3
16-20	4
21-25	5
26 and more	6

5. Highest level of education

Matric	Certificate/Diploma	Degree	Post-graduate	Other
1	2	3	4	5

SECTION B: PERCEIVED EFFECT ON MARKET SHARE AND SALES

What is the perceived impact of imports on the market share and sales of the organisation?

1	2	3	4	5	6	7
Strongly disagree	Moderately disagree	Slightly disagree	Neither agree nor disagree	Slightly agree	Moderately agree	Strongly agree

No.	Statements	Strongly disagree	Moderately disagree	Slightly disagree	Neither agree nor disagree	Slightly agree	Moderately agree	Strongly agree
Sales and Market Share								
1	Locally made brick sales have been on a general decrease over the past 15 to 20 years.	1	2	3	4	5	6	7
2	Imported bricks have become cheaper in recent years.	1	2	3	4	5	6	7
3	Brick importers have gained market share in recent years.	1	2	3	4	5	6	7

4	The competition from imported bricks has not reduced the sales of locally made bricks.	1	2	3	4	5	6	7
5	The market share of local brick manufacturers has increased in South Africa over the past 15 to 20 years.	1	2	3	4	5	6	7
6	Local brick sales will meet futuristic outlooks (set forecast, targets and goals) despite imports.	1	2	3	4	5	6	7
7	In South Africa, a number of customers now prefer to import the similar bricks they used to buy locally.	1	2	3	4	5	6	7
8	Lower prices always represent lower quality on imported products.	1	2	3	4	5	6	7
9	Some customers do not want to pay high price for high quality local products.	1	2	3	4	5	6	7
10	In South Africa, few customers of refractory bricks are closing down due to economic conditions.	1	2	3	4	5	6	7

SECTION C: THE PERCEIVED EFFECT ON MANUFACTURING OPERATIONS AND CAPACITY

What is the perceived impact of imports on the brick manufacturing plant?

No.	Statements	Strongly disagree	Moderately disagree	Slightly disagree	Neither agree nor disagree	Slightly agree	Moderately agree	Strongly agree
Production output								
1	The local brick plant production output has been on a general decrease over the past 15 to 20 years.	1	2	3	4	5	6	7
2	The demand for some specific brick types by local customers has been on a general increase.	1	2	3	4	5	6	7
3	The brick plant has made some operational changes in the past to keep up with foreign competition and brick import traders.	1	2	3	4	5	6	7
4	The demand for some bricks shapes by local customers has been on a general decrease.	1	2	3	4	5	6	7
Capacity utilisation								
5	The capacity utilisation of the brick plant has been on general increase in recent years.	1	2	3	4	5	6	7
6	The local brick making plants sometimes operate intermittently due to low demand.	1	2	3	4	5	6	7
7	Some brick making equipment have been idle in recent years.	1	2	3	4	5	6	7
8	More variety of bricks was produced locally ten years back.	1	2	3	4	5	6	7
9	Local brick production volumes have increased in recent years.	1	2	3	4	5	6	7

SECTION D: PERCEIVED EFFECT ON MANPOWER

What is the perceived effects of imports on the brick plant's manpower?

Statements		Strongly disagree	Moderately disagree	Slightly disagree	Neither agree nor disagree	Slightly agree	Moderately agree	Strongly agree
Manpower								
1	The local brick making industry job market has been shrinking over the years	1	2	3	4	5	6	7
2	The number of people employed in the brick making industry is decreasing due to low brick demand.	1	2	3	4	5	6	7
3	Some jobs in the local brick making plants are under threat	1	2	3	4	5	6	7
4	The brick making industry did not need to make changes to the shifts to adjust for the low demand	1	2	3	4	5	6	7
5	The brick plant has not replaced some vacant positions when employees retire or resign	1	2	3	4	5	6	7

APPENDIX C: INFORMED CONSENT FORM

– Informed consent form –

Dear Participant

This **Informed Consent Statement** serves to confirm the following information as it relates to the officially approved research project at the North-West University on **Assessing the effect of imports on refractory brick manufacturers in South Africa**.

1. The sole purpose of this study is to obtain information for academic purposes from refractory experts like you in order to determine the effects of refractory brick imports on your operations.
2. Participation is completely voluntary, and you may opt-out at any time. You may also decide not to answer specific questions.
3. The research procedure is a quantitative design, which entails a questionnaire. Basic background information will be asked, e.g. function and related experience to the topic.
4. Confidentiality of the data is guaranteed and only the combined results will be used for research and publication purposes.
5. The data gathered from the questionnaires will only be used for research purposes.
6. Please note that there are three classifying variables (employment level, gender and experience) which will be used only to profile the respondents who partook in this study. It will be used in comparative analysis to distinguish the perceived impact among different employee profiles. Only the combined results will be used and at no stage can any specific respondent or his/her data entry be isolated and analysed. (You may also select the option not to answer the specific question should you feel like it.)
7. This study does not have a correct or incorrect answer to any of the questions. In comparing profiles of respondents, there is no correct or incorrect behavioural profile. The study merely assesses the impact of refractory brick imports on your operations.
8. The completion of the questionnaire will take approximately 10 to 15 minutes of your time.

Please indicate your consent

I hereby give my consent after having read the above information that my data may be used as stated above.	YES	NO
I hereby give my consent that my demographic data may be used to develop a profile	YES	NO

Thank you for your time and valued participation.

Yours sincerely  Brighton Mapiku (student)	Principal investigator/supervisor Manda Badnock Badnock.manda@arcelormittal.com Contact no.0718898674
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APPENDIX D: EMS -REC ETHICS APPROVAL LETTER



Private Bag X6001, Potchefstroom
South Africa 2520

Tel: 018 299-1111/2222
Web: <http://www.nwu.ac.za>

Economic and Management Sciences Research
Ethics Committee (EMS-REC)

14 April 2021

Mr B Manda
Per e-mail
Dear Mr Manda

EMS-REC FEEDBACK: 26032021 (Round Robin)
Student: Mapiku, B (33393834)(NWU-00046-21-A4)
Applicant: Mr B Manda - MBA

Your ethics application on, *Assessing the impact of imports on refractory brick manufacturers in South Africa*, which served Round Robin, refers.

Outcome:

Approved as a minimal risk study. A number **NWU-00046-21-A4** is given for one year of ethics clearance.

Due to the Covid-19 lock down ethics clearance for applications that involve data collection or any form of contact with participants are subject to the restrictions imposed by the South African government.

Kind regards,

Prof Mark Rathbone
Chairperson: Economic and Management Sciences Research Ethics Committee
(EMS-REC)